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New York State Education Department

NEW YORK STATE MUSEUM

58th ANNUAL REPORT

1904

VOL. 5

APPENDIX 7

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STATE OF NEW YORK

No. 12.

IN SENATE,

FEBRUARY 15, 1905.

58th ANNUAL REPORT

OF THE

NEW YORK STATE MUSEUM

To the Legislature of the State of New York

We have the honor to submit, pursuant to law, the 58th annual report of the New York State Museum.

WHITELAW REID
Chancellor of the University

A. S. DRAPER
Commissioner of Education

Appendix 7

Entomology 23, 24

Museum bulletins 86, 97

23 May Flies and Midges of New York

24 20th Report of the State Entomologist 1904

Published monthly by the

New York State Education Department

BULLETIN 343 JUNE 1905

New York State Museum

JOHN M. CLARKE Director

EPHRAIM PORTER FELT State Entomologist

Bulletin 86

ENTOMOLOGY 23

MAY FLIES AND MIDGES OF NEW YORK

THIRD REPORT ON AQUATIC INSECTS

A study conducted at the entomologic field station, Ithaca N. Y. under the direction of

EPHRAIM PORTER FELT D.Sc.

BY

JAMES G. NEEDHAM Ph.D. Professor of biology, Lake Forest College

KENNETH J. MORTON F.E.S.L. Edinburgh, Scotland

O. A. JOHANNSEN M.S. Instructor in civil engineering, Cornell University

	PAGE
Preface	4
Introduction	7
Summer Food of the Bullfrog at Saranac Inn. J. G. NEEDHAM	9
Ephemeridae. J. G. NEEDHAM	17
North American Hydroptilidae. K. J. MORTON	63
Aquatic Nematocerous Diptera II. O. A. JOHANNSEN	76
Explanation to the plates	316
Legenda to text figures	331
Plates 1–37	face 332
Index	333

State Museum, Albany N. Y. Oct. 17, 1904

Hon. Andrew S. Draper

Commissioner of Education, Capitol

SIR: I beg to transmit herewith, for publication as a bulletin of this division, a third report on aquatic insects, entitled *May Flies and Midges of New York* by Dr J. G. Needham, Special Assistant to the State Entomologist.

Very respectfully

JOHN M. CLARKE

Director

State of New York
Education Department
COMMISSIONER'S ROOM

Approved for publication Oct. 24, 1904

A. S. Draper

Commissioner of Education

PREFACE

This, the third report upon work begun in 1900, like its predecessors, marks an important advance in knowledge. The first report, State Museum Bulletin 47, consisting of 230 pages and 36 plates, gave the life histories of about one hundred aquatic forms and characterized ten species and two new genera. The most important portion of this work was the monographic account of the larger dragon flies (Odonata Anisoptera). There were also valuable additions to our knowledge of the stone flies (Plecoptera) and the May flies (Ephemeridae), and the admirable account of the Caddis flies (Trichoptera), by Mr Betten, deserves special mention because of its careful biologic treatment of a heretofore much neglected group. The second report, State Museum Bulletin 68, comprised 419 pages and 52 plates and was a continuation of the preceding. The monograph of the Odonata is completed by an exhaustive account of the smaller dragon flies (Zygoptera). Among the important contributions may be mentioned: The key to Coleopterous larvae with an account of some aquatic Chrysomelidae by Dr MacGillivray, the discussion of certain aquatic nematocerous Diptera by Dr Johannsen, and a monograph on the Sialididae of the Western Hemisphere. The present report is a continuation of the work, and among its valuable features should be noted the monographic account of our May flies, a group of great importance as food for fish. The small midges, belonging to the Chironomidae, are very important as fish-food and have been treated exhaustively by Mr Johannsen. These three publications mark a most decided advance in our knowledge of aquatic forms and, with the publication of the monograph on stone flies now in preparation, a large fund of information will be available for the student of aquatic forms.

This study, as was pointed out in the introduction to the first report, has been made upon broad lines with the avowed purpose of producing something of value to the fish culturist, who must first of all be able to identify aquatic forms, something well-nigh

impossible, before these reports were made public. The investigations of Dr S. A. Forbes of Illinois convinced him that nearly one-fifth of the entire amount of food consumed by all adult fishes examined by him consisted of aquatic neuropteroid larvae, the greater part of them being the young of May flies. It may never be possible to rear aquatic insects for the purpose of feeding fish, but it certainly is feasible in some instances to provide conditions adapted to multiplication of aquatic insects, and therefore valuable as feeding grounds for fish. The history of the shellfish industry gives a little idea of the possibilities along this line. A number of years ago it was at a very low ebb, owing to unscientific methods in vogue and the lack of individual control. This has been changed and we now have a thriving industry producing over two million dollars ($2,309,758) worth of products, according to the report of the United States Fish Commission for 1900. It is exceedingly difficult to obtain figures relating to the value of our fresh-water fishes, but a compilation from the report of the United States Fish Commission for the year 1900 gives the total value of fresh-water fish in the Hudson river valley and Long Island at over one million dollars ($1,192,544), and the report for 1901 places the value of fresh-water fish obtained in the State from the Great Lakes at nearly one-fourth a million ($241,916). These figures, it will be observed, give no idea of the value of fresh-water fish taken in various lakes and streams throughout the State, aside from the areas mentioned above. Comparing the water areas available for shellfish culture and those suitable for the development of fresh-water fish, it will be seen that there is a considerable discrepancy in favor of the latter and yet the value of the product is much smaller. It is stated that a large proportion of the market fish of China are grown in ponds, and that carp culture is an important industry not only in China but in Germany, and that formerly carp were extensively reared in England. Germany and Sweden, and lately France, have also done considerable along this line.

It is hardly likely that this country will adopt Chinese methods, because the great difference in the price of labor makes it impracticable; still the proper knowledge of the conditions suitable

for the growth and multiplication of fish may put it within the power of many to make substantial additions to the productivity of areas under control, without great increase in the cost of management. These investigations have been conducted primarily to ascertain the relations existing between fish and insects they feed upon, and the conditions necessary for the development of large amounts of fish-food. Much of the preliminary work has been accomplished, and the data already obtained should prove of great service to parties interested in fish culture, especially in making heretofore barren waters productive.

E. P. Felt
State Entomologist

New York State Education Department

New York State Museum

John M. Clarke Director

Bulletin 86

ENTOMOLOGY 23

MAY FLIES AND MIDGES OF NEW YORK

I. INTRODUCTION.

BY JAMES G. NEEDHAM

This bulletin includes further results of the study of material gathered under the auspices of the New York entomologic field station, and is therefore complementary to bulletins 47 and 68 of this same series. Bulletin 47 contains the more general results of the first field season spent at Saranac Inn, introductory keys to aquatic insect larvae, numerous life histories, and a detailed report of the dragonflies (Odonata-Anisoptera) of New York State. Bulletin 68 contains the main results of the second field season spent at Ithaca, further life histories, detailed reports on the damselflies (Odonata-Zygoptera) of the state, on aquatic plant-beetles (Chrysomelidae), on certain families of nematocerous diptera, and on American Sialididae; also, an account of the food of the brook trout in Bone pond.

This bulletin contains the work of three collaborators who have labored apart on the remaining material gathered for the station. Mr O. A. Johannsen furnishes the major part, in the form of a completed review of the Chironomidae. Notwithstanding that these little gnats are enormously abundant everywhere and are of first importance among insects affecting fish culture, this is the first American monograph we have had dealing with the family to which they belong. It is a generic treatment of the world fauna, together with detailed descriptions and life histories (mostly new) of our known species. It is a

work of first importance, and will doubtless serve as a basis for future studies in this long-neglected family.

Mr K. J. Morton of Edinburgh contributes a paper on the micro-caddisflies of the family Hydroptilidae of Trichoptera, which is practically the beginning of the study of this group in America.

My own part in this bulletin is a second contribution to the knowledge of our may-flies. Because of the great economic importance of this group also, I have thought it worth while to attempt to provide American students with a better introduction to the study of the group than has hitherto been generally available. Hence, in addition to new life histories, I have prepared new generic keys to both nymphs and adults, which, with the detailed explanations and figures, should enable even a novice to take up the study of this neglected group with some hope of success.

I have also prepared a brief report on the summer food of the bullfrog (Rana catesbiana Shaw) at Saranac Inn, and in the discussion of that food have included a number of ecological and systematic notes, among which is a new key to our genera of Hemerobiidae.

I planned also to include herein a report on the stoneflies (Perlidae) and did much work to that end: but the station collections are large, and much material has come to me from friends outside, and my manuscript has grown until it now seems better not to include it herein, but to make a separate bulletin of it. I am therefore continuing the work with the purpose of making the next station bulletin a monograph of North American Perlidae. I should be greatly obliged if American collectors who have even a few specimens would send me them for study.

In this place I may add a note supplementary to bulletin 68. The "unknown tipulid larva from a spring" described on pp.285-286 and figured in pl.10, figs.4-5, is Pedicia albivitta Walker. Had Beling's third paper on Tipulid larvae (Verh. zool.-bot. Ges. Wiel. vol.36) been available to me when I was studying this larvae, I should have been able to determine it from his keys and description. The "unknown leptid larva from rapid streams" of p.286 and pl.10, fig.1, is doubtless a

species of Atherix, as has been kindly indicated to me in correspondence by both Professor A. Giard of Paris and Dr R. Lauterborn of Ludwigshafen.

THE SUMMER FOOD OF THE BULLFROG (RANA CATESBIANA SHAW) AT SARANAC INN

(With plate 1)

BY JAMES G. NEEDHAM

Bullfrogs are common at Saranac Inn. Any warm evening their sonorous notes may be heard reverberating through the tamarack swamps, echoing and reechoing across Little Clear pond between Green hill and the outlet, or rising with a startling crescendo near at hand from the shallows of the reedy creek, setting the thread-rushes trembling, and fretting the face of the water with infinitestimal wavelets, striking with wonder and admiration the ears of the stranger accustomed only to the vocal powers of the lesser civilized frogs, By day they sit in the edge of the water, stolidly basking in the sunshine, picking a straying bee or dragonfly out of the air, or lapping a floating ant or an emerging caddisfly from the surface of the water, eating much or little according to the bestowal of Providence, and when alarmed by our too close approach, plunging away with a single dilatory and awkward leap into deeper water. Their tadpoles, likewise of phenomenal size, are to be seen about the submerged timbers in Little Clear pond and creek. They are oftenest observed resting upon the logs in the sunshine. Frequently, when crossing the bridge over Big Clear creek on the Otisville road during our first field season, I stopped to watch them sunning themselves on the submerged bridge timbers, and often dropped pebbles upon them to see them swim away. They would wriggle and sidle and slide off the timbers, and then with a motion that appeared most deliberate strike a straight course obliquely downward far away across the clear deep waters of the stream, moving slowly forward by sculling undulations of the enormous banner-like tail.

During July and August, 1900, I preserved the food of a number of adult bullfrogs from Little Clear creek, taking the stomachs of chance specimens that were killed for food and preserving and

cleaning the contents. Most of the specimens were obtained for me by my friend Dr O. S. Westcott of Chicago, who was visiting the station at that time. I suggested that he test the efficiency of a hook and line baited with a little piece of red silk flirted near the bullfrogs' heads. He reported the capture of every specimen properly approached; said that bullfrogs are abject idiots; said that if one is not hooked at his first dash for the dangling cloth, but gets his mouth snagged, he will go for the bait again and again as eagerly as at first. It is indeed remarkable how the predatory reflexes incited by the sight of the dangling red cloth prevail over the effects of the wounds.

There now remain in the New York State collection the preserved contents of the stomachs of fifteen of these frogs, and I have studied this material, with the aid of Mr W. H. Ferguson, and report on it here. The following table is largely the work of Mr Ferguson. I have added to it the single record published in bulletin 47 p.401, making 16 in all.

The traditional account of the manner of the bullfrog's feeding pictures him sitting immobile on a bank, watching for insects passing through the air, and, when these approach, capturing them by flirting out his long, bifurcated, sticky tongue and striking them. The picture is incomplete. Doubtless he captures some of the bees and hover flies and others of the fleetest insects in just this way, but the larger, heavier and slower ones he endeavors to meet half way. For instance, on the approach of a big caddisfly or a blackwing damselfly, he becomes greatly excited, especially after an unsuccessful stroke at it, and leaps and plunges toward it with tongue and jaws both reaching for it. Some of the larger of his captives would not be held by the adhesiveness of his tongue without the immediate assistance of his jaws. Moreover, the greater part of his food is not obtained from the air at all, but from plants, from the ground, and from the water, and doubtless, by more deliberate methods. The caterpillars and sawfly larvae of the table were probably picked from plants; the beetles and millipedes from the ground; the water striders, floating dead insects, soldierfly larvae, gnat pupae, and transforming caddisflies from the surface of the water; and the mayfly nymph, gnat larvae and some of the snails probably from beneath the water.

Table of food of 16 bullfrogs

No.	Snails	Crustaceans	Spiders	Millipedes	HYMENOPTERA			COLEOPTERA			DIPTERA			TRICHOPTERA		ODONATA		Hemiptera	Orthoptera	Neuroptera	Lepidoptera	Ephemerida	Miscellaneous
					Ants	Bees	Others	Carabidae	Other adults	Larvae	Adults	Pupae	Larvae	Teneral adults	Sand	Adults	Nymphs and eggs						
1	1	....	1	....	1	....	1	3	....	....	1	1	12	....	....	....	....	6	1	....	1	....	Flower clusters and algae
2	....	....	1	....	3	2	....	1	....	....	2	1	....	1	....	1	1	8	1	....	....	....	
3	....	....	1	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	1	1	....	....	Bur-reed stem; hemlock leaves
4	....	....	....	....	1	....	....	1	....	....	1	....	....	....	....	....	....	....	1	1	....	....	Hemlock leaves
5	....	....	....	....	....	....	....	....	1	....	2	....	....	....	....	1	e	1	....	....	....	....	Hemlock leaves and algae
6	6	....	....	....	1	....	....	....	1	....	3	....	....	1	....	1	....	....	1	....	....	....	
7	....	1	....	1	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	Hemlock leaves and 4 pine leaves
8	....	....	....	....	2	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	Birch bark
9	3	....	....	....	....	....	....	2	....	....	1	....	....	....	....	2	....	....	....	1	....	....	Hemlock leaves
10	....	....	....	1	1	1	....	2	....	1	2	....	....	1	....	1	....	1	....	....	....	....	Hemlock leaves and algae
11	....	....	....	....	1	1	1	2	....	....	3	....	1	1	....	2	....	1	....	....	1	....	Hemlock leaves and algae
12	....	1	....	....	1	2	1	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	
13	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	Leaf fragments
14	....	....	....	....	....	....	....	....	....	....	....	10	2	8	....	....	....	....	....	....	....	1	
15	7	1	....	....	1	....	....	....	1	....	....	....	....	1	1	1	....	1	....	....	....	....	Bullfrog tadpole
16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	Meadow mouse
Tot.	18	3	3	2	12	7	3	11	3	2	15	12	15	15	4	9	2	19	6	3	2	1	
					22			16			42					11							

Notes on the Food

General. Leaving aside the plant fragments eaten, which were of considerable number and variety, which were obtained both from the water and the air (as shown by the presence of filamentous algae and a broken flower cluster in the same stomach), but which were probably all obtained accidentally along with animal food, there were present the remains of 164 animals. Of these the largest number, 139, were insects, 18 were snails, 3 were crustacea, 3 were spiders, and 2 were vertebrates. The most important part of the food is doubtless insects and snails; the former in great variety, the latter consisting of a single species. Leaving aside frog no. 16, whose stomach contained only a large meadow mouse, the other 15 had eaten on an average 9 insects and 1.2 snails apiece.

Of the insects eaten two were millipedes (apparently Julus, but not in condition to identify with certainty) and the remainder were hexapods. The ten orders present had the following numerical representation: Diptera, 42; Hymenoptera, 22; Hemiptera, 19; Coleoptera, 16; Trichoptera, 15 (not including 4 whose presence was evidenced only by sand supposed to have been derived from larval cases); Odonata, 11, and a large mass of eggs of Tetragoneuria; Orthoptera, 6; Neuroptera, 3; Lepidoptera, 2 (larvae); Ephemeridae, 1 (nymph). Of these the six orders first named were present in fairly equivalent proportions, and these, with the snail, Physa heterostropha, may be said to constitute the staple food of the bullfrog in summer at Saranac Inn. The bulk of the snails eaten was certainly greater than that of the insects of any single order. The largest animal eaten was the meadow mouse, and next in size were the two crawfishes.

Vertebrates. There were two vertebrates eaten; frog no. 16 had eaten nothing but a short-tailed meadow mouse (Arvicola pennsylvanicus) of large size; that was enough to fill his stomach to its full capacity. How he came by this sumptuous morsel I am unable to understand unless he found it dead and floating down the creek. Frog no. 15 had swallowed a yearling tadpole of his own species.

Crustaceans. Frogs nos. 7 and 12 had each eaten a crawfish, of which there remained as evidence only the chelipeds. These indicated half-grown individuals of the genus Cambarus. Frog no. 15 had eaten, probably by accident, a minute and undetermined copepod.

Hymenoptera. These collections were made during the season of flight of the winged males and females of the big carpenter ant (Camponotus pennsylvanicus) remains of which were found in nine stomachs. Thus this species occurred a greater number of times than any other. Stranded specimens were frequently seen floating down the creek, and the frogs may as well have obtained them from the surface as from the air. Worker bumble bees (Bombus ternarius Say and B. consimilis Cr.) were found in five stomachs, and these were doubtless obtained alive. The bullfrog would seem to be, like the brook trout, immune to bee poison. The other hymenoptera were but three; a wasp (Vespa diabolica Sauss.) in frog no. 12, a sawfly larva in frog no. 1, and a minute parasitic hymenopter in frog No. 11.

Coleoptera. Of the 16 specimens of this order eaten 12 were Carabidae (11 adults and one larva), and there were single adults of Scarabaeidae, Chrysomelidae, and Curculionidae, and a single larva of Elateridae.

Diptera. This order was represented by the largest number of individuals, but many of them were very small. Six families were represented: Tipulidae, Chironomidae, Stratiomyidae, Syrphidae, Tabanidae, and Tachinidae.

A single adult Tabanid was eaten, two adult Tachinids, four adult Syrphids, the better preserved appearing to belong to the genus Eristalis, five adult Tipulidae, all belonging to moderate sized species of the genus Tipula. There was a single adult Chironomid, but there were eleven pupae, ten of them from frog no. 14, all belonging to the genus Chironomus and one larva from the same frog belonging to the same genus and one belonging in Ceratopogon. A sixth family, Stratiomyiidae, was represented by twelve larvae of Stratiomyia badius? from frog no. 1. In bulletin 47, p.576, I have recorded that I could find but a single specimen

of this species during the season. Of the total of 42 Diptera eaten 27 were larvae and pupae, and these must have been obtained from the water.

Trichoptera. With the single exception of the large Neuronia postica eaten by frog no. 3, all the other caddisflies were teneral imagos, captured probably as they came to the surface in transformation. This was evidenced by the pupal skins still hanging to many of the specimens. All were in bad condition in consequence, and in determining them I placed chief reliance on the characters of the pupal skins. I was able to assure myself that about nine of the specimens belonged to the genus Halesus and another to Hydropsyche. The sand found in four of the stomachs seemed to indicate that larvae in their cases had been eaten earlier and entirely digested. Larvae of Polycentropus lucidus and Molanna cinerea are sufficiently available in Little Clear creek. I have shown in bulletin 68 that the brook trout in Bone pond swallow the larvae of another species case and all.

Odonata. Drangonflies constituted as large a part of the food as any other single group of insects. Although the number was but eleven, the size of the individuals was relatively large, the adult Aeschna and the nymph of Anax being among the largest insects eaten. Four adult and apparently fully colored blackwings, Calopteryx maculata, two adults of Argia violacea and single undetermined specimens of Lestes, Enallagma and Æschna make up the list, together with a nymph of Anax junius and an undetermined nymph of the subfamily Agrioninae. The adults, so far as might be determined, were all females and might have been obtained while ovipositing. Frog no. 4 had swallowed a considerable mass of eggs of Tetragoneuria. In bulletin 47, pp.490-492 (with fig.19) I have given an account of these eggs. The frog probably found a cluster unusually close in shore.

Hemiptera. The water skaters (Hydrotrechus sp?) constitute an important and fairly constant element of the food, 16 of the 19 specimens found being of this genus.

Orthoptera. Five grasshoppers were found singly, the one in condition fit for determination being Melanoplus femo-

ratus and one grouse locust. Considering the abundance of these about the edges of the creek, I was somewhat surprised that more had not been eaten. As many as this may easily have been picked from the surface of the water.

Lepidoptera. Two moth larvae only.

Ephemeridae. A single nymph of Siphlurus alternatus Say was eaten by frog no. 14. It must have been taken beneath the surface of the water as these nymphs do not come to the surface, so far as I have observed, except to transform, and this one was not ready for transformation. I have given an account of the habits of the nymph of this species in bulletin 47 p.424. It was a surprise to me that no adult May flies were eaten.

Neuroptera. Amphibian stomachs offer a new field for collecting representatives of this order, a field in which I have made some of my best finds, and that in a very little material. I found Sisyra umbrata Ndm. first in the stomach of a tree frog, as recorded in Psyche vol.10, p.29, and these bullfrog stomachs contained specimens of a new species of Micromus, and of Climacia dictyona Ndm. and Hemerobius amiculus Fitch,—single specimens of each.

SYSTEMATIC NOTES ON HEMEROBIIDAE

Micromus jonas sp.nov.

Allied to M. angulatus, but smaller; expanse 10mm. Known only from its wings, but these alone will distinguish it (pl.3, fig.2). The fore wing is 4.7mm. long and 2mm. wide, with front and hind margins nearly parallel in their middle third. Their color is rich fulvous, with darker fuscous oblique streaks along the line of both the gradate series, and less distinct, more transverse marmorate lines between, which become arcuate where they traverse the bases of the apical forks beyond the second gradate series; hind wings pale fulvous about margins, the disc transparent, and the veins traversing it very angulate in their course with crossveins incomplete. Gradate veins in fore wing; inner series 5, outer series 4-5: in hind wing; inner series, 3-4, outer series 3-4. Saranac Inn, N. Y. Taken from bullfrog stomach (no.9 of table) in July, 1900.

I have in hand a study of the venation of the Hemerobiidae. This material, especially Hemerobius amiculus Fitch, and another of Fitch's rare species, H. occidentalis from Illinois (which I have recently received from Wisconsin), together with other species of Hemerobius collected at Saranac Inn, Ithaca and in Illinois, have thrown some light on the evolution of the peculiar Hemerobian type of venation. My study will in due time be published elsewhere when it is completed; and the results to be noted here are merely that H. amiculus Fitch and H. occidentalis Fitch represent two stages in the evolution of the type which should be marked by generic rank. I therefore characterize them here and in the form of a key, because the key to Hemerobiidae in bulletin 47 was not made complete for our genera:

KEY TO THE GENERA OF HEMEROBIIDAE

a Branches of the radial sector arising (*i. e.*, separating from vein R_1) by a common stalk
b With three ocelli..... Dilar
bb With no ocelli
c Humeral crossvein (the basal costal crossvein) simple and not recurrent
d Some of the branches of vein Cu_1 forked.. Sisyra
dd All of the branches of vein Cu_1 simple.... Climacia
cc Humeral crossvein recurrent and bearing a number of branches on its outer side
d Subcosta and radius separate at the tips.. Polystoechotes
dd Subcosta and radius conjoined at the tips.. Berotha
aa Branches of the radial sector appearing to arise separately from vein R_1
b Humeral crossvein unbranched and not recurrent (pl.3, figs. 1 and 2)..... Micromus
bb Humeral crossvein recurrent and with branches on its outer side
c First division of the radial sector arising before or opposite the basal subcostal crossvein; in the hind wing the vein M_1+_2 is well separated from the base of the radial sector, with a distinct crossvein between
d A closed cell in the first fork of the radius before the base of the second division of the sector (pl.2, fig.2); front coxae longer than the femora
Spadobius n. gen. type H. occidentalis Fitch

dd No closed cell in the first fork of the radial sector before the base of the second division of the sector (pl.3, fig.3); coxae of fore legs shorter than femora
Palmobius n. gen. type H. amiculus Fitch

cc First of the three or four divisions of the radial sector arising well beyond the basal subcostal crossvein (pl.2, fig.1); in the hind wing vein M_{1+2} is more or less confluent with the base of the radial sector, eliminating or reducing the crossvein between ..... Hemerobius

EPHEMERIDAE

BY JAMES G. NEEDHAM

Since the publication of Museum Bulletin 47 little attention has been given by the workers at the Entomologic Field Station to the collection and rearing of mayflies. Incidentally, however, a number of new and most interesting forms have been brought together, and nine additional species representing as many additional genera have been reared—mostly by Mr Betten and myself during the summer of 1901 at Ithaca. It is the purpose of this paper to give the results of new life history studies, and also new keys for both adults and nymphs, that shall serve as a better introduction to the study of this interesting group.

That the group is of great economic importance in water culture there can be no doubt. Past food studies have demonstrated this; and every aquatic collector has found the waters teeming with the immature stages. There are mayfly nymphs for every sort of situation in fresh water, and they are almost everywhere abundant. These are perhaps the dominant insect herbivores of fresh water. Notwithstanding their ecological interest, the wonderful ways in which they have adapted themselves to diverse modes of life in different sorts of places, and their singular, though fragile, beauty, their study is very much neglected among us. It is in the hope of interesting more of our field workers in them that I have added to the life histories and descriptions, the keys and text figures of the present paper.

Few life histories of American species, whose nymphs have been positively determined by rearing, have as yet been written. The singular nymph of Baetisca obesa Say has long been

known, having been described by Walsh, its discoverer, and by Vayssiere and Eaton. In bulletin 47 I described the nymphs (having in each case bred the species) of Heptagenia pulchella Walsh, Baetis pygmaea Hagen, Siphlurus alternatus Say, Ephemerella excrucians Walsh, Caenis diminuta Walker, Hexagenia variabilis Eaton, and Ephemera varia Eaton. In the American Naturalist for 1903, pp.25-31 of vol.37, Mr Edward W. Berry described the nymphs of ?Habrophlebia americana Banks, Blasturus cupidus Say and Callibaetis ferruginea Walsh, and in Bulletin 68 I described the nymph of Callibaetis skokiana Needham. That is all the bred species that have hitherto been described in America, so far as I know.

In the following pages I describe the nymphs of the following eight bred species, representing as many genera: Chirotenetes albomanicatus sp. nov. Choroterpes basalis Banks, Leptophlebia praepedita Eaton, Caenis allecta sp. nov., Ameletus ludens sp. nov. Ephemerella bispina sp. nov., Heptagenia interpunctata Say, and Ecdyurus maculipennis Walsh, Mr W. E. Howard furnishing an account of the life history of Polymitarcys albus Say, which he has studied at Ottawa Ill., but which I have not seen at large. I add thereto descriptions of five additional species which have not been bred, but to which the names of native genera are assigned tentatively.

Some of the above descriptions are generic rather than specific: the study of the nymphs in some genera has hardly gotten down to the species as yet. Representatives of all these genera are described and figured in Eaton's *Monograph of Recent Ephemeridae,* at least two of them being tentatively referred to the wrong genera, however. But the excellent and copious figures of that work make it possible to refer the five species of unbred nymphs to their genera with some degree of assurance.

I have published directions for collecting and rearing nymphs of mayflies elsewhere,[1] but while speaking of life histories I would not omit to mention how easy it is to get life-history material in

[1] Part O of Bull. 39, U. S. National Museum.

this group. As is well known, there is with mayflies one moult during adult life. The nymph, transforming, leaves the water as a subimago, and later moults again and becomes the imago. The subimago stage lasts but a little while—but a few minutes with the most ephemeral species, about a day with the majority of species, two days with Siphlurus alternatus kept indoors—being much more brief than is the period of transformation of even those species that are most concerted in time of appearance on the wing. It follows from this that when one finds subimagos flying, he can go to the water whence they came and be rather sure of finding, with proper searching, the full-grown nymphs. The subimagos may be recognized by their generally duller coloration, and the possession of fringes of hairs around the wing border (present in the imago of Caenis only among our forms). Grown nymphs may be placed in any sort of a dish of water near a window out of the direct sunlight to transform. The subimagos picked from the window later may be put in paper bags and left to moult again. All stages are best preserved directly in alcohol of about 80 per cent strength.

Besides the material for this paper collected by myself and Mr Betten at Ithaca N. Y. and Lake Forest Ill., and that furnished me from the State Museum collection by Dr Felt, I have received material used herein from Professor T. D. A. Cockerell collected at Pecos New Mexico, from the late Mr R. J. Weith, collected at Elkhart Indiana, from Mr Chauncey Juday, collected at Twin Lakes Colorado, and from Mrs Mary Rogers Miller, collected at Thousand Island Park N. Y., for all of which I return grateful acknowledgment.

For the use of the following keys a little more knowledge of mayfly structure is likely to be required than the average text-book of entomology affords. A knowledge of the names of the parts of the body and legs of the typical insect will be assumed; also, of the principal mouth parts and antennae. It should be known that the male is readily distinguished from the female by the possession of much larger compound eyes, these always being remote from each other in the female, and by the possession of a pair of jointed appendages called forceps that project backward from beneath the penultimate segment of the abdomen. The two

or three filiform appendages which terminate the abdomen are here called caudal setae.

The tarsi are typically five-jointed in the adult, though one or two basal joints show a marked tendency to fuse with the end of the tibia, and the last joint bears two claws of variable form (Fig.5); in the nymph the tarsus is one-jointed and bears a single claw (Plate 6, fig. 7 and 8). The mouth parts in the adult are atrophied and functionless, while in the nymph they are highly developed. But one feature of them needs mention here, however; that is the armature of the mandible. By comparing pl.6, fig.4, and pl.8, fig.6, it will be seen

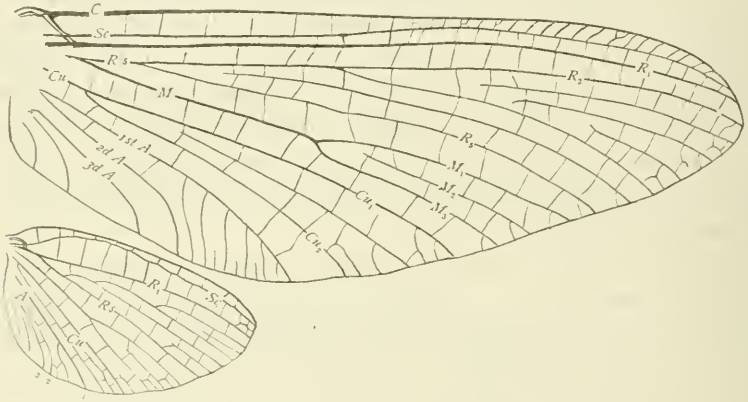

Fig. 1 Venation of the wings of Siphlurus; lettering explained in text

that each mandible bears on its inner side a broad more or less corrugated *molar surface*, and at its antero-lateral angle several variable *canines*.[1]

To the venation of the wings the student who aspires to an acquaintance with mayflies would do well to pay special heed. This is of chief importance because 1) the venation is perfectly definite and easily observed; 2) it suffers least distortion in preserved specimens; 3) it remains the same through the different developmental stages, and 4) the wings are better retained than the other appendages, and progress is better in using a key if the structures mentioned in it have not been lost. The main features

[1]Following the terminology of Vayssiere for these parts. Organisation des larves des Ephémérines: Ann. Sci. Nat. (6) vol.13. 1882.

of the venation are easily learned, and afford a ready clue to the relationships. Eaton says, "Unstable in minutiae, so closely is the essential plan of the neuration adhered to by nearly related mayflies that the general facies of the wing is an important aid to their classification, affording characteristics as easily recognizable as the style of branching in the case of trees."

By reference to figs.1, 2 or 3, or any of the wing figures of the plates, it will be observed that there are three nearly parallel veins extending along the front or costal margin of the wing, costa (*C*), subcosta (*Sc*), and radius (R_1). These three are followed by three forking veins that occupy the greater part of the wing area, the radial sector (*Rs*), the media (*M*) and the cubitus (*Cu*). The middle one of these, the media, forking usually far-

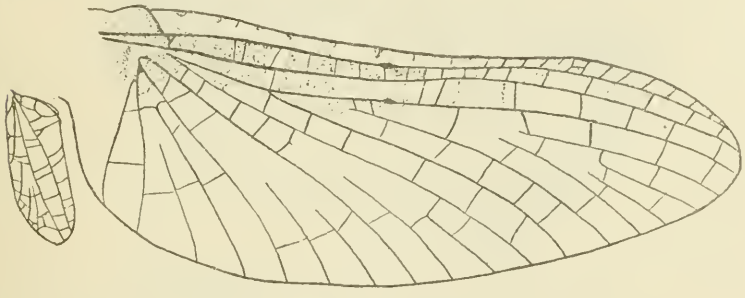

Fig. 2 Wings of Callibaetis

ther outward than the others and being more constant in form, is one of the best landmarks of the wing. All that lies between it and vein R_1 is radial sector, which, in the fore wings of mayflies, is entirely detached from the radius and functions as a separate vein. The only place in the series where there is likely to be any difficulty in recognizing the media is in the few genera closely allied to Baetis (see fig.2) in which both the media and the cubitus are apparently simple; but it will be readily observed by carefully noting the number and relation of the longitudinal veins that the hinder branch of the fork of these two veins is detached, and appears as an independent sector standing on the hinder side; the relative lengths of these veins enable one to recognize them all, even when detached, or when, through shifting of cross veins at their bases, they appear to have formed attachments of a contradictory sort (see vein Cu_2 in pl.8, fig.9). These

three forked veins are followed by three typically simple veins, the first, second and third anal veins, which occupy the smaller area of the hind angle of the wing. There is much variability in this region in the different genera, and it is highly important that these three veins be certainly recognized; to do this it is only necessary to count off the three longitudinal veins of the cubitus—the two branches (Cu_1 and Cu_2) and the bisector of the cubital fork—back of the media, and these three will be the three best developed veins remaining. In the keys the short, inconstant interpolated longitudinal veins are called *intercalaries,* and that whether they become attached to principal veins or branches or remain independent; and the irregular veins about the margin

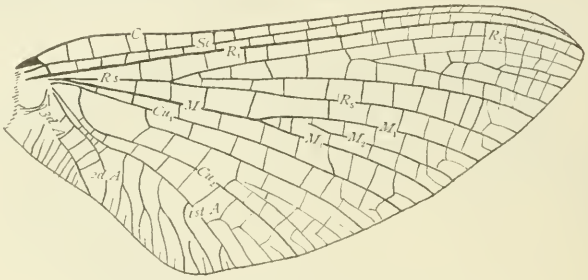

Fig. 3 Venation of the fore wing of Ephemera

of the wing are called veinlets. The length of the media is measured on vein M_2. The fore wing is meant in the key except where the hind wing is specified. Fig.3 shows the unilateral forking of the cubital vein and the divergence of the cubital and first anal veins at base, characteristic of the subfamily Ephemerinae.

KEY TO THE GENERA OF MAYFLIES OF NORTH AMERICA

Imagos

a The cubital and first anal veins strongly divergent at the base (fig.3). Venation never greatly reduced.....Ephemerinae

b The fork of the median vein very deep, almost reaching the wing base; two long simple intercalaries between the first and second anal veins. In the hind wing the vein R_5 separates from vein R_1 close beside and therefore is little longer than the next branch of the radial sector.....Campsurus

bb The median vein forked for not more than three fourths of its length: in the hind wing the vein R_5 arises much in advance of other branches of the sector, being much longer than any of them

c Between the first and second anal veins is a bunch of 3–4 long, straight intercalaries, conjoined basally before their attachment to the principal veins; the second anal vein nearly straight and unbranched ..... Polymitarcys

cc Between the first and second anal veins are only shorter, sinuate, and sometimes forking intercalaries, attached directly to the first anal; the second anal vein sinuate and often branched (fig.3)

d The median vein forked ⅔ to ¾ its length; vein Cu_2 not more strongly bent at base than the first anal..... Euthyplocia

dd The fork of the median vein occupying not more than half its length; vein Cu_2 more strongly bent at base than is the first anal (fig.3)

e The third anal vein simple, but attached to the hind margin by a number of crossveins; in the narrow first fork of the median vein there are one or more crossveins before the origin of the vein M_2; male forceps four-jointed

f Caudal setae 3, ♂ and ♀; fore tarsus of female imago ¾ as long as the tibia..... Ephemera

ff Caudal setae 2 in ♂ and 3 in ♀; fore tarsus of ♀ ⅔ as long as the tibia..... Pentagenia

fff Caudal setae 2, ♂ and ♀; fore tarsus of ♀ as long as the tibia ..... Hexagenia

ee The third anal vein with a simple terminal fork and unattached to the hind margin, although a few isolated short intercalaries lie between; in the wider first fork of the median vein there is no crossvein before the origin of vein M_2; male forceps 3-jointed ..... Potamanthus

aa The cubital and first anal veins parallel at base (in a few forms with reduced and scanty venation, appearing a little divergent)

b Eyes of the male simple and remote; hind tarsi with 5 freely movable segments; venation never greatly reduced; intercalary veins between the first and second anal veins unattached basally and in two pairs, of which the pair nearer the hind angle is the longer (pl.4, figs. 3 and 4)..... Heptageninae

c Basal segment of the male fore tarsus not surpassed in length by any of the succeeding segments

d Second segment about as long as the first and longer than the third ..... Epeorus

dd Second segment shorter than the first and about equal to the third ..... Iron

cc Basal segment of the male fore tarsus shorter than some of the succeeding segments

d Basal segment of the male fore tarsus longer than the fifth segment, the second and third segments of unequal length

e The second segment longer than the third..... Ecdyurus

ee The second segment shorter than the third..... Cynigma

dd The basal segment of the male fore tarsus shorter than the fifth segment, and the second and third segments of about equal length

e Basal segment of the male hind tarsus longer than the third segment ..... Rhithrogena

ee Basal segment of the male hind tarsus shorter than the third segment ..... Heptagenia

bb Hind tarsi usually with but four freely movable segments, the basal segment being more or less completely consolidated with the tibia; eyes of the male enlarged, often approximated on the dorsal side and divided into superior and lateral portions with corneal facets of different size; venation various, sometimes greatly reduced; intercalary veins between the first and second anal never as in *b* above ..... Baetinae

c The three anal veins nearly parallel to the hind margin of the wing and to each other, ending in the outer margin; in the hind wing the branches of the radial vein are strongly unilateral on the anterior side ..... Baetisca

cc Anal veins strongly divergent distally, usually both the second and the third ending in the hind margin; forks of the radial vein in the hind wing more symmetrical

d The median vein with a normal fork; hind wings, when present, usually but little longer than broad and with a copious venation

f The intercalaries between the first and second anal veins variable, but usually more or less independent, and not directly dependent from the first anal; three well-developed caudal setae (except in Blasturus, in our fauna)

g Hind wings present

h Vein M_2 and bisector of the cubital fork independent: between the latter and vein Cu_2 no intercalaries; vein Cu_2 in the hind wing rarely preserved; caudal setae generally much longer than the body; penultimate segment of the male forceps shorter than the antepenultimate

i In the hind wing the subcostal vein reaches nearly to the wing apex; male forceps three-jointed

j Hind wing with a slight concavity at the middle of costal margin; 5-6 longitudinal veins between R_2 and R_5; veinlets numerous about the wing margins and crossveins numerous in the hind wings

k Third anal vein of the hind wing wanting; caudal setae of about equal length.... Leptophlebia

kk Third anal vein of the hind wing present, and often followed by one or two additional intercalaries; median caudal seta distinctly shorter than the others ..... Blasturus

jj Hind wing with an angular lobe projecting forward from the middle of the costal margin; 4 longitudinal veins between R_2 and R_5; wing margins free from veinlets, and few crossveins in hind wing Habrophlebia

ii In the hind wing the subcostal vein terminates in the costa at hardly more than half the length of the wing, just beyond the obtuse angulation having a thickened margin; forceps of male more or less distinctly four-jointed ..... Choroterpes

hh Vein M_2 and the bisector of the cubital fork both tending to attach themselves to the posterior branch of their respective forks; between the latter and vein Cu_2 are generally some short intercalaries (the cubital region thus being better developed than in group *h*); caudal setae about as long as the body; penultimate segment of the male forceps longer than the antepenultimate

i Veins Cu_2 and 1st *A* separate to base.. Ephemerella

ii Veins Cu_2 and 1st *A* fused toward the base Drunella gen. nov.

gg Hind wings absent..... Caenis

ff The intercalaries between the first and second anal veins represented by a series of veinlets, often sinuous or forking, extending directly from the first anal to the wing margin; costal angulation of hind wing close to the base; but two well-developed caudal setae, the median one being rudimentary or wanting; basal joint of hind tarsi evident but not well developed

g Median caudal seta a distinctly segmented rudiment (pl.6, fig.1); forceps of male three-jointed; posterior prolongation of sternum of ninth segment of abdomen of female bifid at tip

h Basal segment of fore tarsus of male shortest; claws of each tarsus unlike each to each; hind wing with the costal angulation acute, and the fork of the median vein occupying two thirds the length of that vein Coloburus

hh Basal segment of fore tarsus of the male longest; claws of each tarsus alike; hind wing with the costal angulation obtuse, and the median vein forked through one third its length..... Chirotenetes

gg Median caudal seta more rudimentary or wanting; forceps of the male distinctly four-jointed; posterior prolongation of the sternum of the ninth abdominal segment in the female entire at tip

h Claws of each tarsus alike; caudal setae at least one half longer than the body..... Siphlurus

hh Claws of each tarsus unlike; caudal setae about as long as the body in both sexes..... Ameletus

dd Median vein apparently simple, its posterior fork (M_3) being detached and appearing as an intercalary; hind wings when present at least twice as long as wide, and provided with but 1-3 longitudinal veins

e Hind wings present
f Fore wings with numerous costal crossveins before the bulla; hind wings with a moderate number of crossveins
Callibaetis
ff Fore wings without costal crossveins before the bulla; hind wings without crossveins or with but 1-3 of them
g Marginal intercalary veinlets in pairs; hind wings oblong, with a short costal angulation.....Baetis
gg Marginal intercalary veinlets of the fore wing single; hind wings linear, with a spur-like costal angulation
Centroptilum
ee Hind wings absent.....Chloeon

Nymphs

a Mandibles with an external tusk-like ramus, visible from above; gills on abdominal segments 1-7 (often rudimentary on 1), double, flattened, linear, the margins fringed with respiratory filaments
Ephemerinae
b Mandibular tusks longer than the head (burrowing species)
c With no frontal prominence
d Legs increasing in length posteriorly; gills of the first abdominal segment simple; labrum longer than wide; maxillary palpus two-jointed .....Polymitarcys
dd Legs decreasing in length posteriorly; labrum wider than long; maxillary palpus three-jointed.....Euthyplocia
cc With a conspicuous frontal prominence
d Frontal prominence rounded.....Hexagenia
dd Frontal prominence bifid at tip.....Ephemera
bb Mandibular tusks shorter than the head, inconspicuous, only their tips visible from above.....Potamanthus
bbb Unknown .....Campsurus and Pentagenia
aa Mandibles without projecting tusk-like ramus; gills not as in *a*
b Eyes dorsal; body strongly depressed; tarsal claws with lateral teeth; dwellers in rapid streams and on wave beaten shores; adopted to clinging to flat surfaces of rocks, timbers, etc..Heptageninae
c Gills represented on abdominal segment 7 by simple, lanceolate or linear filaments, differing markedly from the lamellae of the preceding segments.....Heptagenia
cc Gills of the seventh abdominal segment lamelliform, like those before them, but smaller
d Gills on all the segments divaricate in pairs.....Ecdyurus
dd Gills of segments 1 and 7 approximated at their tips, being decurved beneath the abdomen, those of segment 1 much enlarged
e Head widest toward the front; mandible with its outer canine linear, truncate and denticulate on the end; labrum retracted far back from the flaring margin of the frons; maxilla with its palpus hairy and the tip of its lacinia armed with three large teeth.....Iron

cc Head widest toward the rear; mandible with its outer canine shaped like a shoemaker's last, the heel pointing laterally and the long, slender, acute toe obliquely forward; labrum pendent from the flaring but notched edge of the frons; maxilla without strong teeth at tip of its lacinia and without long hairs on its palpus.....Rhithrogena

bb Eyes lateral; form of body various; claws smooth or toothed below Baetinae

c Gills completely concealed under an enormously enlarged, four-spined dorsal thoracic shield.....Baetisca

cc Gills exposed; thoracic dorsum normal

d Outer caudal setae fringed on both sides

e Gills on abdominal segments 1-7, double

f Gills filamentous

g Each a pair of simple filaments.....Leptophlebia

gg Each a pair of clusters of slenderer filaments Habrophlebia

ff Gills lamelliform, at least on the middle segments

g Lamellae of each gill similar.....Blasturus

gg Lamellae of each gill markedly differing in form at tip (see pl.8, fig.8).....Choroterpes

ee Gills absent from one or more of segments 1-7; one pair more or less elytroid, covering those behind it

f Gills present on the seventh abdominal segment, elytroid on the third or fourth segment; a pair of tubercles on the apical margin of each segment beside the middorsal line

g Head smooth above.....Ephemerella

gg Head armed above with a pair of erect occipital tubercles Drunella, gen. nov.

ff Gills absent from the seventh abdominal segment, elytroid on the second segment; no dorsal abdominal tubercles Caenis

dd Outer caudal setae fringed only on the inner side

c Posterolateral angles of the hinder abdominal segments prolonged into thin, flat, sharp lateral spines

f Fore legs conspicuously fringed with long hairs; gill tufts present upon the bases of maxillae and front coxae and at bases of lamellae on abdomen.....Chirotenetes

ff Fore legs without conspicuous fringes; no maxillary or coxal gills; no gill tufts at base of lamellae on abdomen

g Gills double on the basal abdominal segments; end of maxilla fringed with simple hairs.....Siphlurus

gg Gill lamellae all single; end of maxilla fringed with pectinated hooks.....Ameletus

ee Posterolateral angles of the hinder abdominal segments hardly more than acute—not prolonged in thin flat lateral spines

f Gill lamellae simple

g Lamellae obtuse at apex; maxillary palpus rounded at the apex.....Baetis

gg Lamellae acute at apex; end of maxillary palpus truncated.....Centroptilum

ff Gill lamellae double, at least on some of the anterior abdominal segments

g Antennae shorter than the body; tracheae of gill lamellae pinnately branched ..... Callibaetis

gg Antennae longer than the body; tracheae of gill lamellae palmately branched ..... Cloeon

cee Unknown ..... Coloburus

In the preparation of the foregoing keys I have used freely Eaton's *Monograph of Recent Ephemeridae,* that great storehouse of information concerning the structure of mayflies. Although in a few minor details I have not been able to accept the classification therein given, I wish to acknowledge my obligation at every turn to its great wealth of illustration, and to express my admiration for the spirit in which its classification is set forth: "It is only by taking cognizance of points of difference and agreement in many details, in the anatomy and the mode of development and the habit of leading representatives of the various alliances of genera, at different periods of their lives, before and after their exclusion from the egg, that the mutual affinities of the several associations of genera to one another can be demonstrated adequately. Until such comparisons can be and shall have been carried out, the whole question of their arrangement can only be dealt with in a tentative and experimental manner; and it will be fortunate if error be avoided in the necessary grouping of the genera into provisional alliances of apparently kindred forms, preparatory to the study of their affinities. It is far more easy to demonstrate defects in proposed methods of classification than to devise a trustworthy system in their stead."

I have correlated nymphal and adult structures, and have expressed that correlation in the foregoing keys, wherein all the major divisions are strictly parallel for the two stages. That this is now possible is a sign of progress toward a natural system of classification. The one serious incongruity in Eaton's system—the interpolation of Jolia in the subfamily Ephemerinae; an incongruity that grew out of a previous error, inherited from Joly—the breeding of Chirotenetes has enabled me to remove. The nymph "Jolia roeseli" is doubtless that of the sole European species of Chirotenetes, Ch. ignotus Walker. A comparison of the figures

of pl.27 of Eaton's Monograph with those of my pl. 5 and 6 will show the close agreement of it with Ch. albomanicatus, and demonstrate its generic position. The adult which Joly furnished Eaton as having been bred from this species of nymph was doubtless a poor specimen of Polymitarcys virgo Oliv. This was suspected by Eaton and yet he allowed the adult to determine the position of the species in his system. Doubtless the nymph Jolia furnished a reason for including Oligoneuria and its allies in the Ephemerinae also. The nymph of Oligoneuria is certainly nearest Chirotenetes of all forms hitherto described; and it has not yet been shown that the very degenerate imagos may not as well have descended from this part of the series, and belong in the Baetinae as here understood. My present ideas of the major natural complexes of the order may be expressed as follows:

1 Subfamily Ephemerinae; a fairly homogeneous series.[1]

2 Subfamily Heptageninae; a very homogeneous series.

3 Subfamily Baetinae; a very heterogeneous series, only definable as lacking the characteristics of the other two, and including five fairly distinct groups, some of which may be found worthy to rank as equivalents of 1 and 2 above:

a) The group of Oligoneuria (Oligoneuria to Homoeoneuria of Eaton; pls. 3 and 26 of his monograph); five genera, represented in tropical America and in the old world

b) The group of Baetis, including all our genera of Baetinae except Baetisca, and many exotic genera

c) The group of Baetisca, including Baetisca only

d) The group of Prosopistoma, including the exotic Prosopistoma only

e) The group of the nameless Chilean nymph figured on pl.53 of Eaton's Monograph

[1]These three subfamilies, which I indicated parenthetically in my key to nymphs published in bulletin 47, I had already recognized in 1897. Shortly afterward my friend Mr C. A. Hart, of the Illinois State Laboratory of Natural History, sent me a manuscript key in which these major divisions were plainly indicated, and also a number of minor divisions, including the tribes Baetini and Caenini of Banks (Trans. Amer. Ent. Soc. 26:247. 1900). This key was then already in use by entomological students at the University of Illinois, the basis for these divisions having been recognized independently and, perhaps, prior to my own recognition of them.

While the breedings of mayflies now to be reported upon are not very numerous, they could hardly be better distributed for the purpose of supplementing existing knowledge. The Chirotenetes life history is the most important, because of the difficulties and discord it clears away. It is well supplemented by the breeding of Ameletus, which shows that to this genus belongs the nymph that Eaton referred by supposition to Chirotenetes (Monograph, pl.40). Furthermore, the other new life histories represent additional genera or very striking species. A few notes are added concerning species whose life histories have been previously known.

The following notes and descriptions follow no systematic order of arrangement, but are ordered as was convenient in writing them:

Baetisca obesa Walsh

This singular mayfly, known hitherto from Rock Island, Illinois and Indiana, the place of its discovery, has been found at two places in New York State: In the Niagara river, by Mr E. P. Van Duzee of Buffalo, and at Newport, where a single nymph was taken May 30, 1902, by Mr D. B. Young and is now in the New York State Museum collection. I have also received specimens from Mr R. J. Weith, taken in the St Joe river at Elkhart, Indiana, but only a few subimagos, however. The rather striking color pattern of the wing of the male subimago (in the imago the wing is wholly hyaline) is well shown in the accompanying figure reproduced from a photograph (pl.4 fig.1). I present on the same plate (fig.2) a new figure of the nymph also. It is absolutely unique among mayfly nymphs. Its huge four-spined carapace is formed by a backward prolongation of the thoracic dorsum. It meets a conspicuous pyramidal elevation on the middle of the abdomen to inclose a respiratory chamber, within which the gills are included. The labium (fig.4) is most inter-

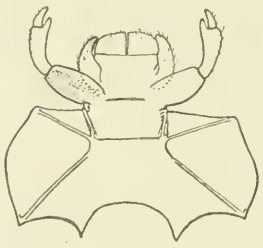

Fig. 4 The nympal labium of Baetisca obesa Say. (The two muscle bands indicated by dotted lines in the basal segment of the left palpus are the same that move the lateral lobe of the dragonfly labium)

esting also, because it offers a transition form to the Odonata. A comparatively slight degree of consolidation of the labial parts here present, and a slightly better development of the two points at the tip of the palpus (of which the last joint is homologous with the movable hook, and the internal prolongation of the preceding joint equals the end hook of the Odonata), would give the grasping labium, so characteristic of the nymphs in that order.

Much has been written concerning the anatomy of this interesting species—especially the anatomy of the nymph. A full bibliography and a new description with some excellent figures are given in Eaton's Monograph, pp.226–229, pl.21 and 42.

Less is known concerning its manner of life. In a general way it may be said to inhabit the more rapid portions of our larger rivers and to be very local. It is rare in collections.

Chirotenetes albomanicatus sp. nov.

The white-gloved howdy[1]

Plates 5 and 6

This is the common Ithaca species, whose nymph is figured on page 87 of Comstock's *Manual for the Study of Insects*. It has been referred hitherto to Ch. siccus Walsh. It differs from Walsh's description of that species in its larger size, later season of appearance, separateness of eyes in male subimago, coloration of front tarsi and of forceps and in conspicuous black transverse apical lines on abdominal segments. It agrees better with Eaton's description and fairly well with his figure of that species, but I doubt whether Eaton had the species of Walsh. Pending the reidentification of Walsh's species, I think that less confusion will result if this one be kept apart under a new name.

This species is abundant in all the rapid streams about Ithaca. I have observed the nymph, especially in those places where the creek bed is flat shelving rock over which the water streams in a thin sheet. In such places the flat, rocky floor of the stream is

[1]Lest it be not discerned, I will state openly that the common name "howdy," which I apply to the members of this genus, is a very free translation into western vernacular of the generic name.

covered with a thin, filmy growth of algae, with abundant nets of the caddisfly seine-maker, Hydropsyche; and the broken edges of the floor ledges are fringed with black masses of black fly larvae, Simulium. Simulium and Hydropsyche are fixed in their places, but Chirotenetes wanders about freely over the ledges, clinging securely even in the swiftest water, keeping of necessity head up stream, moving by short quick dashes, effected by sharp strokes of its powerful tail fin and gill covers, moved synchronously. It is also found in the stiller pools at the sides of the current, in which dwell other mayflies of the genera Caenis and Baetis; and also among the rocks in the current, under which cling other nymphs of Heptagenia, Blasturus and Choroterpes.

Measurements. Length, imago and subimago, ♂ 11-12 mm.; ♀ 12-13.5 mm.; setae additional, subimago, ♂ 13; ♀ 11; imago, ♂ 23; ♀ 20; fore leg of ♂ and ♀ subimago and of ♀ imago two thirds as long as body, of ♂ imago seven eights as long as body.

Subimago. Color brownish tinged, with tawny changing to rufous with age, with a pale middorsal line the entire length of the body dilated and overspreading the dorsum of the mesothorax. Fore legs rufous, with whitish or pale lutescent tarsi, of which the sutures are narrowly marked with brown in the male. Middle and hind legs wholly pale. Wings subhyaline, paler on the inner margin, all crossveins bordered with ashy brown (pl.5, fig.2). Abdominal segments pale brown, the apical margin with a transverse apical line and the lateral margins with a longitudinal dash of darker brown; last segment and setae and appendages wholly pale. The ventral prolongation of the ninth segment in the ♀ is bifid apically as in the imago, but not declined at the tip. The eyes of the male are not contiguous, and the forceps limbs are straight, and surpass the tip of the rudimentary middle seta by the length of the latter.

♂ imago. Thorax brownish, abdomen rufescent; head pale lutescent below, rufescent above between the black-ringed ocelli and the eyes. Thorax darker brown above and below and paler along the sides, but without definite markings. Fore legs bright rufous, with wholly white tarsi; middle and hind legs wholly pale whitish. Wings hyaline. Abdominal segments rufous, transverse apical carinae and lateral margin distinctly lineate with blackish brown; segment 10 paler, yellowish rufescent, strongly produced backward above in a broad obtusely truncated superior

lobe. Along the sides of the abdomen is an interrupted line of black dashes on the lateral margin and there is a minute black dot above the anterior end of each dash on either side of each segment. Setae white, slightly tinged with yellowish on basal segments, but not ringed. Forceps (pl.6, fig.1) long and arcuate, the basal segment of each limb feebly differentiated; coloration pale yellowish white, slightly infuscated in the middle.

♀ imago. (Plate 5, fig.1). Head above whitish or very pale luteous; ocelli ringed with black; a black spot beneath each eye and another at its hind angle above upon a minute triangular backward prominence of the occipital margin. Thorax tawny yellowish brown above, the hind margins of the tergal sclerites narrowly margined with blackish brown; venter deeper brown. Wings and legs colored as in the male. Abdomen brownish rufescent, less rufous than in the male, but with the apical lateral margins more distinctly lineate with blackish brown. Segment 10 pale, produced above into a posterior rounded lobe. Segment 9 produced below in a long acutely bifid lamina, decurved at the apex, and surpassing the level of the tip of the superior lobe on segment 10.

A noteworthy feature of both subimago and imago, hitherto apparently unnoticed in any mayfly, is the persistence of the maxillary and coxal gill tufts of the nymph. These are present as conspicuous blackish tufts on the inner sides of the front coxae and at the sides of the atrophied maxillae. They are most conspicuous (probably because less dessicated) in the subimago, but the constituent filaments, filled with black pigment, are easily recognized in either.

The nymph. (Plate 5, figs. 3 and 4). Length of full grown female 13 mm., antenna 4 mm. and seta 7 mm. additional.

Body rather stout, thorax slightly compressed, abdomen strongly depressed and upcurved posteriorly, its sides parallel as far as the seventh segment, and distinctly wider than head and thorax, then tapering to the base of the stout setae. Integument strongly chitinized.

Head short with vertical face, evenly contoured above, covered at the sides by the low, broad, well-rounded eyes. Middle ocellus directly in front but the other two visible from above. A median frontal vertical carina below the middle ocellus ends in a stout, sharp downwardly directed triangular spine. Antenna (Plate 6, fig.6) stout, naked, basal segment stouter and paler, the shorter segments immediately succeeding brownish, the succeeding segments again pale to the tip. Mouth parts unusually hairy, the

somewhat quadrangular labrum covered above with stout bristles and fringed beyond the bristles around its border with copious soft yellowish hairs (pl.6, fig.2). Labium with two jointed palpi of singular form, the basal joint of each cylindric, naked; the second joint twice as long, flattened, its inner margin straight, its outer margin arcuate, its exterior border closely beset with a single linear series of long thin setae, its apex bearing a minute obtuse inwardly directed prominence, set off by a minute notch from the inner margin, and perhaps representing the remains of a palpal segment (pl.6, fig.3). Galea and lacinia hairy beneath, the latter less than half as large as the former and more triangular in outline. Mandible naked (pl.6, fig.4), the outer canine tridentate at tip, the inner one spine-like, but with a flat margin on one side below overlapping the palp. Maxilla (pl.6, fig.5) with palpus two-jointed and similar in form to the labial palpus; end of lacinia terminating in a long straight spine; a copious tuft of gill filaments takes origin under the base of the stipes.

Thorax strongly arched dorsally and slightly flattened laterally. Legs short and stout, the tibia longest in the fore leg, where one third longer than the femur, decreasing in length successively on middle and hind legs. Fore legs with a remarkable development of stiff fringes of tawny hairs, a single ventral fringe on the femur, a double fringe beneath the tibia, the basal portion containing hairs as long as the combined tibia and tarsus, but the length of the fringe diminishing apically, and a much shorter single fringe beneath the tarsus. There is also on the fore leg a single elongate and flattened tibial spur, more than half as long as the tarsus, and strongly recalling by its form and structure the flat spur on the swimming legs of the diving beetle Cybister (pl.6, fig.7). The single tarsal claw is short and arcuate and denticulate on its inferior margin; on middle and hind tarsi the claw acquires a special convexity on the basal part of its inferior denticulate surface, especially marked in the hind tarsus (pl.6, fig.9). There is a large tuft of several times forked gill filaments attached to the base of the fore coxa within.

Abdomen cylindric at base, becoming depressed and upcurved posteriorly and laterally carinate, the lateral margins on segments 8 and 9 ending in long, straight, sharp lateral spines, half as long as their respective segments. There are minute and inconspicuous lateral spines also on segments 1 to 7, hardly more than acute angles on 1-4. Gills on segments 1-7, covered by obovate protecting lamellae (Plate 6, fig.10), which are slightly oblique, increase slightly in size on segments 1-3 and are equal on 4-7. Each lamella has the front margin, the

base of the hind margin and a diagonal superior carina strongly chitinized. The purplish white-tipped gills are clustered in small flat tufts of 2-3 times branched filaments attached to the bases of the lamellae, and they are shorter than the shortest of the lamellae. Setae stout in basal half, with dense internal fringes of tawny hair. There is a darker band across the middle beyond which the tips are slenderer, and the fringes disappear, the whitish tips being bare.

Color, rich chocolate brown above, paler below and on sutures, a pale median stripe extending upward from the mouth over the head and ending upon the prothorax. Tibiae and tarsi pale with broad median rings of brown.

The fore legs are widest apart and the middle ones most approximate at base.

The dates of my bred specimens are July 12, 14 and 19, 1901. Transformation takes place at the surface of the water as in other species, and the subimago stage continues about 24 hours. On warm nights in midsummer subimagos swarmed into my trap lanterns above Fall creek, Ithaca, but no imagos came to them. Imagos were easily taken along the sides of the gorges anywhere, sitting rigidly, their white fore feet extending full length forward; so they would sit and allow themselves to be picked up with the fingers. This is a fine species, interesting for the agility of the nymph in the water and for the rich coloration and striking attitude of the adult.

Food. With a view to more accurately determining what is the food of this species I had microscopic mounts made of the cleared stomach contents of nine well-grown nymphs from Fall creek. Plant remains constituted in all cases fully half of the stomach contents—in some cases a much greater proportion. There were recognizable remains of numerous Cyanophyceae and other algae, and numerous stalked diatoms of the Gomphonema group (which may have been taken in with the larger plant stems to which they were attached), but the greater part was a brownish mass of remains of the decaying leaves of higher plants. That Simulium larvae had been eaten by four of the nymphs was determined by the presence of isolated rays of the fans. Ecdyurus maculipennis nymphs, common in the stream and of favorable size for the food of this species, had been eaten by at least seven of the speci-

mens examined, as evidenced by the presence of recognizable remains; the claw (fig.11) or the curiously coiled malpighian tubules, or the outer canine of the mandible (fig.13). Nymphs of some species of Caenis had been eaten by four, and a small platode and a very young nymph of Chirotenetes by a single specimen.

Ameletus ludens sp. nov.

The genus Ameletus has not hitherto been known eastward of the Rocky mountains. It is represented in the State Museum collection at Albany by a number of nymphs and two

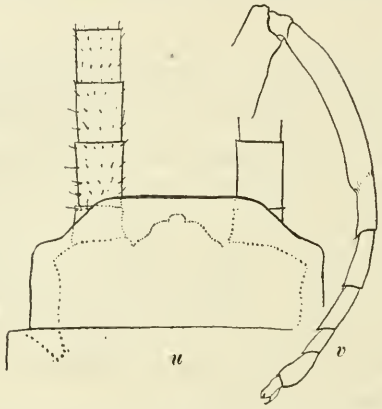

Fig. 5 Ameletus ludens sp. nov., female subimago; u, end of abdomen below, showing truncate apical lobe of the 9th sternum; v, fore tibia and tarsus

bred female subimagos taken by Mr. D. B. Young at Newport, N. Y. on the 22d of May 1902. They were found in the headwaters of a small, swift stream, elevation about 900 feet, in the Hasenclever hills, a spur of the Adirondacks.

Female subimago. Length, 9 mm.; setae, 6 mm. additional; wing, 8 mm. Color obscure brownish, paler on the sutures and below; antennae darker toward the tip; incomplete dark-brownish rings about the ocelli; on the vertex a pair of longitudinal blackish marks, confluent in the middle; a broad median whitish tract upon the mesothorax, produced behind and dilated at the sides; subapical paler bands on the femora, the tips again darker; wings uniformly pale fumose, the venation is shown in pl.8, fig.9; brown marks on the ventral ganglia, becoming more evident posteriorly.

The accompanying text figures will facilitate the recognition of this species when more and better specimens are at hand.

This species is a typical representative of Ameletus, agreeing in close detail with the generic characters set forth in Eaton's Monograph p.210, but it is smaller than any of its congeners. Its nymph is apparently the one figured by Eaton on pl.49 of his Monograph, and referred to Chirotenetes.

The nymph. (Pl.7, fig.1.) Length, 9.5 mm.; antennae, 1 mm., and setae, 4 mm. additional. Body elongate, with vertical face, arched thorax, depressed and tapering abdomen. Antennae short,

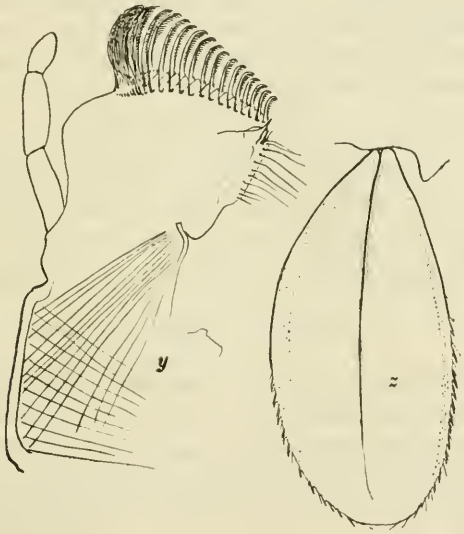

Fig. 6 Parts of nymph of Ameletus ludens sp. nov.; y, maxilla; z, single gill lamella from one of the middle abdominal segments

tapering, bare; ocelli in front; labrum quadrangular, a little longer than wide, emarginate in front, where fringed with fine plumose hairs. Mandibles stout, triangular beyond the molar surface, bearing the canines upon the prominent apex, outer canine more than twice as large as the inner, the latter preceded by a slender subulate spine on the distal margin. Maxilla with a very weak and slender and obscurely three-jointed palpus. The combined lacinia and galea obscurely trapezoidal, the tip of the former indicated by a short, slender and sharp spine, the distal border of the galea fringed densely with a series of strongly arched, regularly graduated and beautifully pectinated hooks (fig.6*v*). Labium with better developed, three-jointed palpi,

cultriform galeae, fringed with spinules externally, and broadly triangular laciniae, separate to the base.

Prothorax rather short, closely applied to the front of the large mesothorax; wing cases reaching the apex of the second abdominal segment. Legs rather short, stout, pale, with darker lines upon the sutures, the darkest one at the base of the claw.

Abdomen gradually tapering, gracefully upcurving in the rear. Gill laminae on segments 1-7, similar in form on all the segments (fig.6z); smallest on segment 1, largest on segment 6, obovate, with a somewhat thickened front margin, and a longitudinal dorsal chitinous ridge. There are no free gill filaments attached to lamellae. Lateral spines on segments 4-9 straight, sharp, increasing in size posteriorly. Setae rather short and stout, equal, fringed copiously within, traversed by a broad distinct band of brown which occupies their middle third, and slightly washed with brown again at the extreme tips.

This nymph differs from the one figured by Eaton (pl.49, Monograph) in having the middle lobe of the tongue (hypopharynx) bilobed. This genus differs from all others as yet known except Thraulus in the possession of a pectinated fringe on the distal border of the galea of the maxilla.

Choroterpes basalis Banks

This species I have studied in the Fall creek gorge beside the Cornell Insectary at Ithaca. It is a very common species there. The nymph is found among the smaller stones in the side currents of the creek in the bottom of the gorge, associated with other nymphs of Ecdyurus maculipennis, Baetis, Caenis etc. It clambers about under these stones, and when they are lifted out of the water it is easily picked off by hand. The form of the gill tips (Plate 8, fig.8) will instantly distinguish it from all others in the stream.

Imagos were abundant about the middle of July. My bred specimens are dated July 14, 1901. Not many imagos were observed at large except on early afternoons, when the sunshine was warm and bright. Then they would swarm out in the opening of the gorge, and dance high up in the air between the banks of green in myriads. Rising and falling in rapid undulations, moving in large companies up and down the gorge, they rarely descended low enough to bring the lowermost within the reach

of the net; and when by climbing on a big rock in the opening I captured a netfull of them I found they were all males. About the same time also subimagos swarmed into my trap lanterns that overhung Fall creek, and a few imagos with them.

The nymph. (Pl.7, fig.2.) Length, 7 mm.; antennae, 3 mm., and setae, 7.5 mm. additional. Body strongly depressed, widest across the rather prominent mesothorax. Head flattened above; eyes round, prominent, situated just before the hind margin. Antennae situated midway the length of the head, which before them is pilot shaped, dilated at the sides and sharp-edged. Ocelli three, rather large, situated in a nearly straight transverse row in the male, in a triangle in the female. Labrum half as long as broad, widened anteriorly, rounded on the anterior angles and deeply emarginated in front, where fringed with short stiff bristles (pl.8, fig.5). Mandible (pl.8, fig.6) stout, its two canines each tridentate on tip, its palp deeply bifid; on the inner margin just before the molar surface is a low conic tubercle. Maxilla (pl.8, fig.4) short and stout, the palpus two-jointed, the consolidated galea and lacinia squarish, the tip of the former ending in a long and distinctly pectinated spine, the inner and distal margins densely fringed with slender hairs. Labium (pl.8, fig.3) with three jointed palpi, the broad galeae and the narrow laciniae with their tips on a level, and densely fringed with spinules, the spinules on the laciniae being stouter.

Thorax depressed, increasing in width to the bases of the wings. The wing cases reach the base of the fifth abdominal segment. The legs are rather short and stout, with flattened and dilated femora and slender tibiae, pale with a more or less complete brownish ring beyond the middle of the femora and some fainter markings at the knees.

Abdomen depressed, regularly tapering from the third segment to the end, segments slightly increasing in length to the ninth, the tenth somewhat more than half as long as the ninth, produced above in a rounded lobe with a narrow blackish border that is interrupted by paler in the middle of the margin. There are sharp, triangular lateral spines on segments 4-9, increasing in length and sharpness on the succeeding segments, represented on segments 2 and 3 by mere angles of the flat margin, on 8 one fourth as long as the segment. Gills very peculiar; on segment 1 a simple linear or slightly tapering filament (pl.8, fig.7) that is fully as long as the succeeding lamellae; on 2-7 double, lamelliform, with pinnately branching tracheae; each of the pair of lamellae is typically three-lobed; the middle lobe of the uppermost lamella is itself lamelliform, oval or oblong, separated by

marginal notches from the two other lesser lobes (pl.8, fig.8). The middle lobe of the lower lamella is likewise flat, but narrow, linear, and with a better development of the two other lobes at its base. There is a slight decrease in length on segments 2-7; and on 2, and again on 7, the anterior of the three lobes of the upper lamella is scarcely developed. Setae three, fragile, slender, with minute apical whorls of spinules on the segments.

Color olivaceous brown above, with a variable middle pale line, fenestrate upon the dorsum of the abdomen with paler olivaceous. Below, with a broad pale median area.

Several of my nymphs from Fall creek have colonial Vorticellidae attached promiscuously about the dorsum, or aggregated about the bases of the setae.

Pl.8, fig.1, shows the venation and fig.2 of the same plate shows the form of the appendages of the male imago in this species.

Baetis pygmaea Hagen

This dainty little mayfly, which I described in bulletin 47 (pp. 421-423, pl.15, fig.13 and 14), I bred also from nymphs obtained in Fall creek with those of the preceding species, and I took a few specimens of the imagos in trap lanterns hung about the creek during July 1901.

Callibaetis skokiana Needham

I wish to record here concerning this species that I have made a careful examination of microscopic mounts of the stomach contents of ten well-grown nymphs taken from the Gym pond on the campus of Lake Forest College in Illinois, and have found them containing no recognizable animal remains whatever, but only remains of plant tissues, chiefly the disintegrating fragments of the dead leaves of the higher plants, such as litter from the pond bottom, with a scanty sprinkling of algae—Cyanophyceae and stalked diatoms.

Blasturus cupidus Say

I have found his species common in Six Mile creek at Ithaca, where I bred it in 1897. I have apparently identical nymphs in my collection from Elkhart, Indiana, and Raleigh, North Carolina. The imagos of this genus appear in late spring. As before remarked, Berry has described the nymph in the American

Naturalist vol. 37, pp.27-29, 1903. It will be at once distinguished from all other genera by the form of the gill lamellae,

Fig. 7 Gill lamellae of the nymph of Blasturus cupidus Say; e, from the 1st segment; f, from the 4th segment; g, from the 7th segment

a figure of which is herewith given (fig.7). There are well-developed lateral spines present on abdominal segments 8 and 9 only.

Ephemerella

This is one of the genera of Ephemeridae that shows great nymphal specialization independently of adult life. The nymphs are obviously very diverse in form and structure; the imagos very much alike, or else their differences are easily overlooked. Eaton pointed out in his Monograph the remarkable differences between the nymph which I have since bred and shown in bulletin 47 to be that of E. excrucians, and that of the European E. ignita, the only bred species with which he was acquainted. He referred to this nymph as a new unnamed genus allied to Ephemerella; but it is the nymph of the typical species. I describe herein the nymphs of two native species closely allied to E. ignita. I have compared both nymphs and adults with E. excrucians. I have not found differences that would seem to justify the generic separation of the imagos; and notwithstanding the evident differences of the nymphs, I think they may as well, for the present, at least, remain associated together under the one name. The nymphal differences are chiefly in the number and arrangement of the gill lamellae, and these things are perhaps most subject to the influence of environment.

Among the other four North American nymphs described by Eaton are two that will doubtless represent good and distinct genera; and one of these I have been able to identify; for it I erect the new genus Drunella. The structural relations between the American nymphs of the Ephemerella alliance described by Eaton and those I have since obtained may be set forth by means of the following key:

a Antennae inserted in deep angular notches in the front margin of the frons; dorsal hooks of abdomen wanting; nymph from Colorado, imago unknown[1]

aa Antennae inserted upon the upper surface of the frons; dorsal hooks hooks more or less developed in a double row upon the abdomen

b Head armed with high occipital tubercles; hind wings visible at the sides below the fore wings.....Drunella gen. nov.

bb Head smooth above; hind wings visible on the dorsum between the bases of the fore wings

c Gill lamellae present on abdominal segments 3-7

d Front femora strongly tuberculate on inner margin; lateral spines of abdominal segments poorly developed, the abdominal margin not serrate. Eaton's no. I from Washington[2]; imago unknown

dd Front femora smooth on inner margin; lateral spines of abdominal segments strongly developed

e Dorsal hooks of abdomen erect, high, strongly developed Ephemerella bispina sp. nov.

ee Dorsal hooks of abdomen slightly developed, hardly elevated above the surface. Unknown species from New York (p.45)

cc Gill lamellae present on abdominal segments 4-7

d The operculate anterior lamella of the 4th segment covers succeeding lamellae but imperfectly, these successively protruding their whole apical margins. Eaton's no. IV; imago unknown[3]

dd The operculate anterior lamella of the 4th abdominal segment covers closely all succeeding lamellae, only their extreme apical margins visible

e Body hardly more than twice as long as wide; Ephemerella sp? from Pecos N. Mex.

ee Body more than three times as long as wide Ephemerella excrucians

Drunella gen. nov.[4]

I have determined the nymph of this genus by means of the venation of the developing wing. Professor Cockerell sent me two nymphs from Pecos New Mexico, one of which, a male

[1] Eaton no. III. Monograph, p.132, pl.39, 22 figs.

[2] Monograph, p.131, pl.38, figs. 1–10.

[3] Monograph, p.133, pl.40, 17 figs. (Colorado)

[4] To my friend, Professor Theodore Dru Alison Cockerell.

specimen, is in perfect condition for showing the venation. It shows the basal fusion of veins Cu_2 and 1st A that Eaton long since described and figured as characteristic of Ephemerella grandis Etn (Monograph, pl.14, fig.24*b*). This character, together with the rather strong joinings together of the other anal veins basally, readily distinguished this large species from Ephemerella proper. The figures of venation I give herewith (pl.10, figs. 1 and 2) are drawn from the nymphal wing, which shows the venation better than does the single female imago I have seen. I have another identical nymph collected at Twin Lakes Colorado, by Mr Chauncey Juday. Since the type of E. grandis is from Colorado, it seems very probable that the nymph belongs to this species. In pl.10, figs.3, 4 and 6 I present figures of the male nymph, which differs slightly from the female, figured by Eaton.

Ephemerella bispina sp. nov.

The six specimens of this species that I have seen were sent me in the last lot of material received from the late Mr R. J. Weith. They were collected at Elkhart Indiana, shortly before June 18th—the date on which they reached me at Lake Forest. There were among them single male and female imagos, a male subimago, and three nymphs. The species is apparently near to E. walkeri Eaton from Albany river near Hudson's bay—still so insufficiently known—and to E. ignita Pol. of Europe.

Imago. Length, 9 mm.; wing, 9 mm.; setae of ♀, 10 mm. (of ♂ wanting); of ♂ subimago, 6.5 mm.

Male imago deep brown, varied with olive green. Antennae brown; a whitish ring around their bases. Thorax rich dark brown above and on all carinae, greenish in the sutures and furrows, excepting the median longitudinal furrow. Beside the median prolongation of the hinder lobe of the mesothorax is a pair of acute spines, each decurved at tip and about as long as the space between them is wide. Wings subhyaline; veins pale brownish, as is also the subcostal space. Legs brown, the femora sprinkled with distinct blackish dots; fore leg dark, becoming gradually lighter toward the tip; middle and hind legs paler and tinged with greenish; claws all brown, the obtuse one of each pair darker than the other.

Abdomen pale brown, except the 10th segment which is yellowish, paler on the sutures and thereby appearing ringed; an in-

distinct middorsal row of minute brown longitudinal dashes. Appendages all brown, the inner ones angulated and thickened in the middle and bent upward thereafter to the tip (this appearing only in lateral view; hence not shown in the figure); forceps (pl.10, fig.10) strongly directed downward, the basal segment distinctly differentiated, the apical segment unusually long and slender.

The female imago is greenish yellow, with pale whitish legs and setae. The basal segments of the antennae are brown and there is a pale brownish tinge to the dorsum of the thorax and the lateral margins of the abdomen. Wings hyaline, veins whitish. The ventral apical lobe of the 9th abdominal segment surpasses the tip of the 10th segment and is obtusely rounded apically.

The male subimago is dark greenish brown, darker on the head, the top of the thorax and the apex of the abdomen; the abdominal sutures, however, are distinctly paler. Legs pale yellowish or greenish, the fore tarsus pale brownish. Wings smoky brown. The two dorsal apines are paler in the ♂ subimago and absent in the ♀.

The nymph. Length, 9 mm; seta, 4.5 mm, additional. Body elongated rather slender, depressed, thinly hairy, widest across the mesothorax. Head short; face oblique. Antennae hardly longer than the head, almost bare. Labrum quadrangular, one fourth wider than long, emarginate in front and hairy on the front border, the hairs being longest on the outer angles. Mandibles short and thick, with the outer canine very broad, 3-toothed at apex, the inner canine of equal length but slenderer; molar surface narrow. Maxillary palpus hardly half as long as the lacinia. Third joint of the labial palpus a conic rudiment.

Thorax flat below, well rounded above; legs short and thinly hairy; claws (pl.10, fig.5) with inferior row of about 10 denticles.

Abdomen depressed, its lateral margins serrate by reason of the flat lateral spines in which the side margins of segments 3-9 terminate. There are two rows of dorsal spines on segments 3-8, erect laterally, flattened, almost cultriform. Gill lamellae present on segments 3-7, double; anterior lamina thickened, covering the delicate posterior one, trapezoidal, obtusely pointed at its inner apical angle, palmately veined; posterior lamina shorter, thinner, its margins cut into a small number of fingerlike filaments. The lamellae regularly overlap, each anterior lamina covering the basal fifth of the one behind it, that of segment 7 shorter. Setae closely parallel, slender, fragile, sparingly pilose. Their two proximal articulations faintly ringed with brown. Color olivaceous, with a broad band of brown extending from the rear of the eye to the base of the lateral caudal seta. There is also a narrow middorsal line of brown on the abdomen.

This species differs in the nymphal stage from the nymph next described, chiefly the presence of well-developed dorsal hooks and the absence of black rings on the base of the setae.

Ephemerella unicornis sp. nov.

Along with the six specimens of E. bispina came a single male of another apparently very distinct species, distinguished at a glance from all the others by an erect conic tubercle upon the front margin of the middle lobe of the mesothorax. This species is notably smaller, measuring but 5 mm. in length, with the setae of the same length and the wing hardly longer. The hind wing also is marked with a more distinct basal costal angulation than is common in this genus. The spines beside the backward prolongation of the middle lobe of the mesothorax are present also in this species but apparently not so large. Unfortunately the specimen, although perfect, is a subimago, and the mature coloration can not be given; it will probably be brownish since in the subimago it is greenish as in E. bispina. The abdominal appendages are well enough developed to show that the end segment of the forceps will be much shorter than in E. bispina, while the inner appendages will probably be of the same type as in that species, though probably relatively shorter.

Ephemerella sp?, near ignita

This species occurs at Ithaca, but I have thence but a single nymph. There are two nymphs in the U. S. National Museum labeled "From stream on Mr Chamberlain's farm, Richfield Springs, N. Y., May 13, 1837." It is very closely allied to the European E. ignita, as figured and described by Eaton (Monograph, pl.40; whole figure copied in Cambridge Natural History, vol.5, p.436, fig.282).

One of the two nymphs from Richfield Springs is apparently grown. It measures in length 8 mm., setae, 3.5 mm. additional. Body rather more elongate than in the typical species; eyes laterally prominent; abdomen (pl.10, fig.7) strongly depressed, the usual submedian double row of dorsal tubercles scarcely indicated. Lateral spines, thin, flat, sharp, on segments 4-9, a mere tooth on 4, increasing in size thereafter to segment 8, broader and less sharp on 9. Gills present on segments 4-7, double, on 4 scarcely

operculate, overlapping the next behind it hardly more than that one overlaps its successor. Setae slender, pale, ringed with dark brown at base, thinly hairy except at base (Plate 10, fig.7).

Ephemerella sp?

Professor T. D. A. Cockerell has sent me from Pecos, N. Mex., a single nymph of so remarkable form (Plate 9, fig.2). I desire to make it known herewith. Its affinities are obviously with Ephemerella excrucians, and it differs from all the "allies of Ephemerella" figured by Eaton from western North America. Therefore I briefly characterize it here and present a figure made from a photograph of the single known immature specimen.

Body excessively flat and thin, about twice as long as wide, widest across the middle of the abdomen. Head short and much narrower than the prothorax; eyes and ocelli dorsal, remote; antennae short, bare, about as long as the head is wide, composed of only about twelve segments, of which the basal one is as usual longest and thickest.

All lateral margins very hairy. Prothorax half as long as wide, straight on front and sides with rather acute front angles, somewhat widened posteriorly. Legs short; femora flattened, widest before the middle and fringed on both margins.

Abdomen short, about as wide as long, excessively flat, with huge, serrate lateral spines on segments 2-9, increasing in breadth posteriorly, but longest on the middle segments, all strongly curved posteriorly. Segments slightly increasing in length successively to the 8th, 9 much longer, 10 only about one fifth as long as 9, but slightly produced on the dorsal side. Gills covered by an oblong opercular lamella attached at the apex of segment 4. Of the underlying gills I have made no examination, not wishing to injure the unique specimen. Setae 3, closely parallel at base, broken in the specimen. Coloration very obscure, the animal being apparently covered in life by adherent silt, but there is a trace of a brownish ring on the middle of each tibia and another on each tarsus.

Pecos, New Mexico, July or August 1903.

Professor Cockerell sent me from Pecos also a fine pair of imagos and these may represent the same species as the nymph above described. I should have felt inclined to refer these to Ephemerella inermis Eaton but for the conspicuously bifid prolongation of the 9th abdominal sternum in the female;

this Eaton describes as being entire. Otherwise, there is close agreement. The length is 7 mm. in male, 8 mm. in female; setae; 10 mm. in male, 6-7 mm. in female. The segments of the male fore tarsus in order of diminishing length are 2, 3, 4, 5, 1, the first segment being one fifth as long as the second. The legs are wholly pale. The setae of the male are strongly ringed with black except at the extreme tip in the male, wholly pale in the female. The head and thorax and basal segments of antennae are brown. The abdomen in the male is rufous, paler on the middle segments, and suffused with brownish apically above; in the female abdomen there are broadly triangular transverse basal bands of paler on the middle segments. The posterior prolongation of the sternum of the 9th segment in the female abdomen is deeply divided by a wide U-shaped notch. The abdominal appendages of the male are shown in pl.10, fig.9.

Ephemerella excrucians Walsh

In Bulletin 47 I published a description of the nymph of this species (pp.425-426), bred at Saranac Inn. On June 30, 1901, Mr. J. O. Martin gave me a live nymph which he had just collected from the shore of Cayuga lake, and I reared this also. Since that time I have received a large number of specimens from different places in Indiana, notably from Elkhart, sent me by the late Mr R. J. Weith. From some of the latter, selected to show the great variety in depth of color pattern, I have had a new photographic figure made, which I present herewith (pl.9, fig.1). It will serve immediately for comparison with the very different form of nymph found in the species above described. On pl.10, fig.8 are represented the abdominal appendages of the male imago.

? Caenis allecta, sp. nov.

This is the commonest species in Fall creek at Ithaca. It swarmed into trap lanterns hung about the creek during July. Its nymph lives in the pools and side channels of that turbulent stream, where the water flows gently among small rock fragments over a bottom thinly strewn with silt. Imagos of our smallest species, Caenis hilaris Say, come to the trap lanterns with this one, but in smaller numbers; its nymph I have not found.

Imago. Length, 3.5-4.5 mm.; setae, about 10 mm. additional; expanse of wings, 8 mm.; fore leg of male, 3.5 mm.

General color brown, marked with purplish or slaty gray; head and thorax brown, carinae and margins of ocelli blackish. Wings hyaline, with the usual purplish streak along the radius for two thirds its length. Abdomen pale yellowish brown on base and apex, the middle two thirds washed with gray; some elongate blackish marks on the lateral margins of the 7th to 9th segments; setae white; antennae, femora and forceps yellowish; tibiae and tarsi, except the terminal joint, white. Venation of the wing and the male forceps as shown in the accompanying figures (figs. 8 and 9).

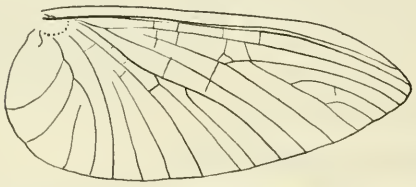

Fig. 8 Venation of wing of ? Caenis allecta sp. nov.

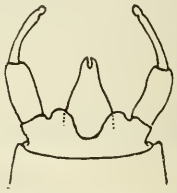

Fig. 9 Ventral view of male abdominal appendages of ? Caenis allecta sp. nov., imago.

Nymph. Length, 2.5-4 mm.; setae, 1.5 ♀ to 2 mm.; ♂ mm. additional.

Color greenish brown, obscure on the head, with a transverse broken and obscure line between the paired ocelli, antennae and legs pale, a pair of brown submedian dots on the prothorax; abdominal segments pale basally and on the sutures; gill covers darker beyond the basal third; segments 8-10 darker with a middorsal pale line on 8 and 9. Lateral spines on segments 3-9, flat and thin, best developed on the middle segments, becoming less divergent posteriorly and losing their lateral fringes of spinules. Setae stout at base, rapidly tapering; middle one distinctly longer in female and shorter in male than the laterals, all with scanty apical circlets of spinules on the segments. Legs scantily and abdomen copiously beset with short hair that is usually covered with adherent silt.

Aside from the not very satisfactory differences of coloration, this nymph differs from that of C. diminuta in having the sides of the prothorax parallel; in diminuta the prothorax is widened anteriorly, and in having a greater part of the abdomen covered by the opercular lamella; in this species that lamella

covers part of the 8th segment; in d i m i n u t a it does not wholly cover the 7th segment.

Were it not that these differences of structure of the nymph are so slight I should have thought a separate genus necessary for this new species; for the differences in venation and in the genitalia are certainly as great as usually serve for generic separation. These principal differences may be tabulated as follows:

Character	Caenis diminuta, hilaris, etc.	C. allecta
Anal veins	disconnected	conjoined basally
Vein M_2	absent	present
Crossveins	uniserial	pluriserial
Forceps of male	one-jointed	three-jointed
Basis	straight edged	bilobed at sides and emarginate in the middle

Among some mayflies that were kindly collected for me by Mrs Mary Rogers Miller at Thousand Island Park, on the St Lawrence river, are a number of typical specimens of our two previously described species, C. d i m i n u t a Walker and C. h i l a r i s Say, that fit the descriptions exactly. In order to promote accuracy in the determination of the most difficult forms, I have prepared the drawings herewith presented (pl.11, figs.3-6) of the wings and male genitalia of these species. It will be observed by comparing the wings with Eaton's figures that in venational characters ? C. a l l e c t a agrees better with the Europaean genus T r i c o r y t h u s and the South American genus L e p t o p h y e s, than with C a e n i s . But there are disagreements also with these, and the ♂ genitalia and nymphs of these are as yet not certainly known.

Leptophlebia praepedita Etn. ?

This species, hitherto known only from New Hampshire and not yet reported from New York State, is common about Lake Forest, Illinois, where I have found it in three quite diverse situations: 1) in the Skokie (north branch of Chicago river), a sluggish creek flowing through open meadows and marshes;

2) McCormick ravine, where a puny stream, overhung with witch-hazel and dogwood, flows between deep banks through a hardwood forest; and 3) in a glacial pothole, grown full of buttonbush (Cephalanthus) on the top of a moraine. In all these situations the water is fairly permanent, disappearing only in seasons of extreme drouth.

The species appears to be diurnal in its habits. Males may be found in abundance sitting on top of the leaves of shrubs beside the water, or flitting over them in the bright sunshine, quickly gathering in companies and dancing up and down, and as quickly dispersing and settling again. They fly at low elevation, and are easily taken in large numbers in a net, and are as easily swept when at rest from the witch-hazel leaves.

I found the species first in the Skokie May 8, 1901. There were then a very few subimagos on the wing, and a bed of mixed ranunculus and polygonum in the water was fairly swarming with the nymphs. I took a large number home and placed them in a bowl of water, where they began transforming the next day. The subimago stage lasts about 24 hours.

When Eaton described the species he had some doubts as to whether it should go in Leptophlebia; but the characters of the nymph are in essential agreement with those of the typical species of Leptophlebia, and thus confirm the reference of the species to that genus. In pl.11, fig.1, is represented the venation, and in fig.2 the ♂ abdominal appendages are shown.

The nymph. Length of body, 6.5 mm.; antennae 2 mm. and setae 6 mm. additional. Body slender, scarcely depressed, widest across the mesothorax, smooth. Face nearly vertical, ocelli in front, eyes rather small situated just before the hind angles of the head; antennae pale, basal segments rather stout, the following ones rather tapering to slender and very fragile tips. Mouth parts very similar to those of Choroterpes, shown on pl.5, the maxillae more oblique on the end of the combined lacinia-galea, and lacking the pectinated spine tipping the former; the palpi, however, are three-jointed beyond the basal palpiger, and the palpi of the labium are two-jointed; thus the conditions of segmentation in these appendages are reversed in the two forms; this segmentation, however, is often very indistinct, and more or less evidence of division of the last segment when there appear to be but two are generally discoverable in all the palpi.

Legs rather short, nearly bare; femora scarcely flattened, but somewhat concave on the side applied to the body; pale brownish, paler at the sutures. Wing cases reaching posteriorly as far as the apex of the 3d abdominal segment.

Abdomen very slightly depressed, regularly tapering posteriorly, its segments very slightly increasing in length to the 9th, the 10th a little shorter on the dorsum, where produced backward in a rounded lobe, one half shorter at the sides; short lateral spines on segments 8 and 9, larger on 9, the lateral angles of the preceding segments obtuse.

Gills present on segments 1-7, double, similar, or slightly longer on the middle segments, divided in nine tenths of their length into two long, slender, simple tapering filaments, pigmented with purplish along the tracheae. Setae 3, equal, nearly bare at base and sparingly whorled with spinules beyond, gradually tapering to long slender tips.

General color olivaceous, paler below, with a very narrow median pale line on head and prothorax, a median row of pale spots on the abdomen of the female becoming larger posteriorly, and a pair of spots either side on segments 3-9, becoming confluent with the median one on 9; male darker and more uniformly brown.

May 8, 27, 30, 31; June 13, 14, 18.

Heptageninae

I deem it necessary to state that I have scarcely entered into the study of this interesting and difficult complex of interrelated forms, having dealt at first hand only with those species in whose life histories I have become interested. The foregoing keys for this group of genera are based largely on characters culled from Eaton's Monograph, and these are but a few of the many characters therein given, and the value of these few as absolute distinctions of closely allied genera I have not personally tested. This group should furnish a most inviting field for some special student, especially here in North America, where it is so abundantly represented.

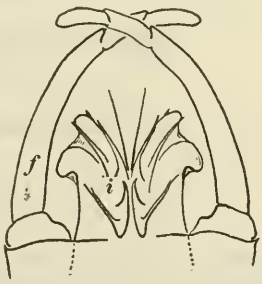

Fig. 10 Ventral view of male abdominal appendages of Ecdyurus maculipennis Walsh, imago; f, forceps; i, inner appendages

In this group the independent specialization of the nymphs is extreme. Their life is relatively long, and the conditions under

which they dwell are very diverse. The conditions of adult life are, however, much the same in all; and we find the adults much more alike. The beginner will certainly find them much more difficult to distinguish, and would do well to study nymphs and adults together. The critical diagnosis of the species will doubtless rest on the highly individualized genital armature of the male. A suggestion of the strength and definiteness of the characters presented by these parts may be had from reference to the accompanying figure of the male forceps and inner appendages of Ecdyurus maculipennis (fig.10). These project strongly from the ventral side of the apex of the abdomen, and are easily separated therefrom in fresh or

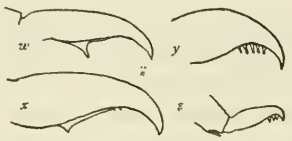

Fig. 11 Tarsal claws of nymphs of Heptageninae; w, of Heptagenia interpunctata Say; x, of Rhithrogena elegantala Etn. ?; y, of Iron sp ? from Coy Glen, Ithaca; z, of Ecdyurus maculipennis Walsh; hind claws in each case; middle ones would be similar; front ones sometimes different

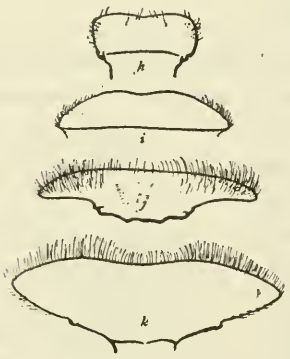

Fig. 12 Labra of nymphs of Heptageninae; h, of Iron sp? from Coy Glen, Ithaca; i, of Rhithrogena elegantula Etn.?; j, of Ecdyurus maculipennis Walsh; k, of Heptagenia interpunctata Say

Fig. 13 Mandibles of nymphs of Heptageninae; c, of Rhithrogena elegantula Etn. ?; d, of Iron sp? from Coy Glen, Ithaca; e, of Ecdyurus maculipennis Walsh; f, of Heptagenia interpunctata Say

alcoholic specimens by a longitudinal snip with a pair of fine scissors. They may then be permanently mounted on a slide as microscopic preparations so as to give a square ventral view. It is from preparations so made that all the figures of the male appendages in this paper have been drawn.

The nymphs in this subfamily are recognizable at a glance by their dorsally placed eyes, with the lateral flaring margins of the sides of the head projecting beneath them. They are all strongly depressed also, and have lateral pectinations to the tarsal claws (fig.11), aiding them doubtless in clinging to their supporting surfaces washed by currents of streams or waves of shores. Further than this, however, there is very great diversity among them, and Ecdyurus, Iron and Rhithrogena furnish a most interesting illustration of a special adaptation to life in torrents. In Ecdyurus (pl.10, fig.3) the gill lamellae

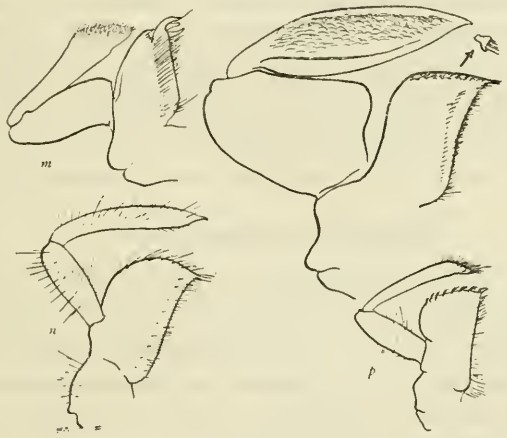

Fig. 14 Maxillae of nymphs of Heptageninae; m, of Iron sp? from Coy Glen, Ithaca; n, of Heptagenia interpunctata Say; o, of Rhithrogena elegantula Etn.?; p, of Ecdyurus maculipennis Walsh

are all divergent and the gill filaments are beneath their bases. In Iron (pl.10, figs.6 and 7) and in Rhithrogena (pl.10, fig.4 and 5) the abdomen is more limpet-shaped, and the gill lamellae form a closely overlapping series whose outer border fits the supporting surface to which the nymph clings as closely as do also the flaring lateral and front margins of the head; but this is not all, the gills have migrated outward and now lie upon the bases of the lamellae, exposed on the outside to the stream of water which now dashes over, but does not flow beneath the lamellae. Furthermore, by the enlargement and approximation beneath the thorax of the foremost lamellae and by the depression and inward curvature beneath the tip of the abdomen of the hindmost of them, there is formed beneath the abdomen a disk for

adhesion to the surfaces of the stones, fairly well developed in Iron, very perfect in Rhithrogena. So complete is its border that when applied to the surface of a stone, any elevation of the abdomen would create a partial vacuum beneath it. It doubtless serves in a different way the same purpose as the row of smaller discs possessed by the larva of the net-winged midge (Blepharocera), found in the same situations; and among anatomical shifts for a living is one of the most remarkable known to me.

The three figures of mouth parts of nymphs of the four genera hereinafter described (figs.12, 13 and 14) show very considerable structural differences. It is because of the remarkable definiteness of such minute parts as the canines of the mandible that I have been able to determine with certainty some of the elements of the food of nymphs of Chirotenetes albomanicatus, its food being all reduced to very minute fragments.

Heptagenia interpunctata Say

This is the commonest species in Fall creek at Ithaca, with E. maculipennis a close second. Both species swarm into trap lanterns set about the creek during July—mostly subimagos just risen from the water. During the daytime imagos are easily found sitting on the vegetation along the sides of the gorge. H. interpunctata is also a common species on the shore of Lake Michigan near my home in Lake Forest, being very abundant along shore in the latter part of August, associated with H. flavipennis Walsh, and a few scattering specimens may be taken as late as September.

The rather well marked color pattern of the wing of this species is shown in the photograph reproduced in Plate 4, fig.4.

The nymphs of this species are found in all the streams about Ithaca in rapid water under large stones. They are distinguishable at a glance from those of all other species by the black markings of the under side, shown in pl.6, fig.3.

The nymph. (Pl.6, fig.3). Length of full grown female nymph, 9.5 mm.; antenna, 2 mm., and setae, 11 mm. additional.

Body strongly depressed, widest across the head, but with the sides behind the head parallel to the middle of the abdomen, thence tapering rather rapidly to the base of the setae.

Head flat, almost orbicularly rounded, limuloid, the inferolateral margins thin, flat, flaring, fringed with decurved hairs. Eyes distinctly dorsal, the lateral margins of the head projecting beneath them. Antennae minute, hardly longer than the head, the basal segments brown and the remainder pale.

Mouth parts as shown in figs. 12h, 13f and 14n.

Prothorax with its declined and flaring lateral margins decurrent upon the sides of the mesothorax; legs short; femora much flattened, and with well-developed posterior fringes of hair; similar fringes on middle and hind tibiae, but scarcely developed of fore tibiae.

Abdomen rather short, strongly depressed, and much tapering beyond the 7th segment; lateral spines on segments 2-9, on 3-5 minute, on 6-9 strong, straight and sharp, longest on 7 and 8, the tip of that on 8 reaching the level of the middle of the 9th segment. Segments of the abdomen diminishing slightly in length to the 7th, the 8th and 9th, then successively a little longer; 10th produced in a rounded posterior lobe.

Gills represented on segments 1-7, on 1-6 double, consisting of an anterior protecting lamina and a posterior basal one, margined with respiratory filaments, whose tips are visible at the inner margin of the lamina. Gill lamella on 1 oblong, somewhat oblique, with a small lobe beside the basal attachment on the side next the median line of the body; on 2-6 similar, becoming somewhat more elongate and less oblique; posterior lamina with its outer two fifths cut into a border of 1-2 branched respiratory filaments. On segment 7 there is a simple linear lanceolate filament (representing the anterior lamina only) whose tip reaches the level of the apex of the 9th abdominal segment.

Setae long, slender and very hairy for more than half their length, the hairs distinctly shorter externally; tips pale, whitish, ringed with darker and nearly destitute of hair.

Coloration olivaceous or greenish brown, darker on head on sides of prothorax and on dorsum of abdominal segments 6 and 10. On the head there is a pale spot before the middle ocellus, another one between each lateral ocellus and the eye, and an oblique pale streak extends from the eye to the margin below it. A pale, narrow middorsal line extends from the rear of the head to the metathorax. The legs are pale, with two broad light-brown bands on each of the femora. On each of the exposed abdominal segments is a transverse pale basal area which includes on each segment, except the 6th, a pair of brownish dots; these dots are elongated into longitudinal dashes on segments 8 and 9. Abdomen beneath conspicuously barred with brown (pl.9, fig.3), one angulated bar on each segment, the bars interrupted in the

middle on both basal and apical segments, but best defined apically.

Bred at Ithaca 18th July, 1901.

Heptagenia sp. no. 3

The nymph of this species was not bred. Like the two preceding it is strongly marked and easily recognized. It occurs in the larger streams, clinging to rocks in the swiftest currents.

The nymph. (Pl.6, fig.4.) Length, 10 mm.; antenna, 3 mm., and setae 13 mm. additional.

Body rather elongate, scarcely wider across the head than across the mesothorax. Head strongly depressed, evenly rounded in front, with flaring infero-lateral margins, dilated at the sides and distinctly visible outside the eyes. Antennae slender, pale. Prothorax slightly narrowed posteriorly, its margins flaring, dilated. Legs moderate, pale; femora with indistinct median and apical darker bands, and with a scanty development of the usual posterior fringes of hair. Wings reaching the level of the base of the 4th abdominal segment.

Abdomen regularly tapering posteriorly. Segments 8-10 slightly diminishing in length, 10 a little produced on the dorsal side, and produced in a sharp triangular spine on each lateral margin; lateral spines developed only on segments 7-9, best developed on 8.

Gills represented on segments 1-7, on 1-6 double, consisting of an anterior protecting lamella and a posterior respiratory lamella whose border is cut into a long fringe of branching gill filaments; upper lamella obliquely oval, produced at the tip into an acute spine-like point, becoming broader distally (obovate) on 4 and 5, and narrower again on 6. On segment 7 there is a simple linear hairy filament, obtuse at the apex and hardly reaching the level of the base of the lateral spine on the 8th segment.

Setae 3, long and hairy, the hairs becoming whorled and finally obsolete toward the tip.

The distinctive features of the color pattern are shown in the photographs reproduced in pl.9, fig.4. These are a broad pale middorsal band divided with brown on the posterior abdominal segments, lateral pale dashes at the sides of the abdominal segments, and a brown longitudinal dash either side of segments 8 and 9 below.

Ecdyurus maculipennis Walsh

As remarked under the account of the Heptagenia interpunctata, this species was found commonly in Fall creek, at Ithaca. Its larvae were more commonly found at the edges of the stream; those of that species oftener in the current, but both often occurred together. This is a dainty little species with narrow wings, conspicuously marked with black on the crossveins (pl.4, fig.3). My bred specimens bear the dates July 9th, 13th and 14th, 1901.

The nymph. (Pl.7, fig.3.) Length, 7 mm.; antennae, 2 mm., and setae, 5 mm. additional.

Body strongly depressed, elongate triangular in outline, widest across the dilated, depressed and squarish frons, and rather regularly tapering posteriorly; head rather flat above; paired ocelli larger and more approximate above in the male than in the female; antennae slender and short. Mouth parts as shown in figs.12j, 13e and 14p.

Legs short, femora flattened, with a thin external fringe of hairs; tibiae slender and somewhat tapering; wing cases reaching the level of the apex of the 3d abdominal segment; abdomen rather short and slender, slowly tapering to the apex, middle segments longest, segments 8 and 9 slightly shorter, 10 again longer on the dorsal side, but shorter at the sides and below; lateral spines present on segments 5-9, longest on 6 and 7, straight and sharp; setae divaricate, the median one in the mature nymph more slender; the apical rings of brown on the segments of the setae are alternately broader and narrower, and the apical whorls of setae are excessively short.

General color pattern olive brown, mottled with pale greenish, darker on head and prothorax, divided by a median narrow pale line, and varied upon the sides with pale hieroglyphics; abdomen with pale and indistinct fenestrate markings along the sides. In the male there are broad dorsal blotches on the dorsum of segments 4 and 5; in the female, on segments 7, 8 and 9.

Iron sp?

This species has not been bred. It is found in Coy Glen—a spring-fed stream near Ithaca, possessing a rich and peculiar fauna. Among our forms hitherto made known this species is peculiar in the possession of but two caudal setae in the nymphal stage. I have a number of nymphs collected years ago, from which, unfortunately, the date label has become detached.

The nymph. (Pl.7, figs.6 and 7.) Length, apparently full grown, 9 mm.; antenna, 1.5 mm., and setae, 9 mm. additional.

Body elongate, strongly depressed, widest across the front of the head and the mesothorax, these being of about equal width; head widest across the front well before the eyes, and strongly narrowed posteriorly to the obtuse hind angles; infero-lateral margins of the head thin and flaring as usual, and closely fringed with hairs; antennae short, slender, pale. Mouth parts as shown in figs.12h, 13d and 14m.

Dorsum of the prothorax a little produced laterally, and angulate obtusely in the middle of the sides. Legs moderate, tibiae and femora all with well developed external fringes of hair; femora very moderately flattened and dilated, the fore femora most so; tarsal claw pectinate, there being two to four minute teeth at its anterior border before the apex (fig.11*y*). The wing cases reach the base of the 4th abdominal segment.

Abdomen regularly tapering posteriorly, its segments increasing in length to the middle. Two lateral spines each side of segments 2-6 and one on segment 7, all stout, triangular, and directed outward.

Gills represented on segments 1-7; on 1 a very large, broadly and obtusely triangular flap of membrane shaped like the gill scoop of a crawfish, attached by the middle of one of the sides, its front end extending forward and lying against the base of the hind leg, its hind end overlapping the succeeding gill lamella. On segments 2-7 the lamellae are ovoid, dorsally carinate, obtusely pointed membranous plates, each with regularly arcuate front margin overlapping the hind margin of the one on the preceding segment, and each bearing at its base a tuft of 7-15 short, finger-like gill filaments. The lamellae diminish in breadth posteriorly, and become less divaricate in pairs, and the tips of the 7th pair are curved beneath the abdomen.

Setae 2, rather short and stout, the median seta being represented by a minute triangular rudiment. The tips of the developing male forceps project beyond the apex to the 10th segment.

This remarkable nymph dwells in the swiftest parts of the stream, and its whole organization exhibits the most wonderful adaptation to life in such a place; the extra grappling armature appended to its claws and especially its flattened form with *thin edges all the way around* closely applicable to the supporting surface, and admirably adapted to divert the flow of the water. Probably the oval enclosure of the gill lamellae of the ventral side of the abdomen acts as a sort of sucker, and holds the animal

securely to the rock surface. The net winged midge Blepharocera is the commonest associate of this species in Coy Glen.

This is another genus that has not hitherto been known eastward of the Rocky mountains.

Rhithrogena elegantula Etn ?

For the sake of illustrating a still more perfect development of the ventral abdominal disk framed with gill lamellae, as well as illustrating the variety of form in this group, I insert here a figure and a brief description of a nymph from Twin Lakes, Colorado, sent me for study by Mr Chauncey Juday, collected in the summer of 1902:

The nymph. (Pl.7, figs.4 and 5.) Length of full grown female nymph, 10 mm.; male, 9 mm.; antennae and setae broken. Body short, stout, flat, narrowly elliptical behind the dilated head; head widest across the eyes, semicircular in outline, its thin lateral margins naked; behind the widest portion the sides converge with very great abruptness to the hind margin; antennae short and stout and bare, the joinings of the segments becoming oblique apically. Mouth parts as shown on figs.12i, 13c and 14o.

Prothorax three to four times as wide as long, produced at the sides in an obtuse projecting angle; legs rather short and nearly bare, the femora moderately curved and flattened with a fringe of rather stiff, very short bristles on the curving superior carina; each of the claws with a basal lateral tooth (fig.11*r*).

Abdomen short and ovate; gill plates on segments 1-7 membranous, white, obtuse, closely superposed at their broadly overlapping edges, bearing copious tufts of long, simple gill filaments at their bases above. The anterior ends of the lamellae of the 1st segment meet beneath the metathorax, and the incurved tips of those of the 7th segment meet beneath the slightly upcurved tip of the abdomen. Setae in male 2, with a rudimentary middle one, in female 3 well-developed, bare, the median paler than the others; extreme bases of setae brown, like the general integument of the body.

Ephemerinae

Since the publication of bulletin 47 I have made no new breedings in this subfamily, but my friend Mr W. E. Howard of Ottawa, Ill., has reared and studied our Polymitarcys albus Say and has prepared at my request the following

account of that interesting species, which differs in some respects from the well-known Polymitarcys virgo Oliv:

Polymitarcys albus Say

BY W. E. HOWARD

This description was undertaken at the request of Prof. Needham, who identified the imago for me. Without his kind assistance in this respect, as well as in many others, it would not have been prepared.

Nymphs of P. albus are abundant in both the Illinois and Fox rivers at Ottawa. These rivers flow at this place over bottoms of solid sandstone, with bars of loose sand accumulated in the eddies. The streams are swift in the main currents, and the nymphs of this species are to be found under flat stones at the edge of swift water when about ready to transform. It was from two such situations that most of my collections were made, from which I succeeded in breeding a single specimen. I have seen the subimagos emerge and arise from the surface of the water in great numbers, but always just far enough out from the shore, so that the nymph skins were immediately swept into the current, where they disappeared before they could be procured. The difficulty in collecting the skins from the natural breeding places is further heightened by the emergence occurring during the evening twilight.

According to my observation, not only this species but all others observed invariably emerge from the nymph skin at the surface of the water and leave the skin afloat. This makes the collecting of the sloughs a much more difficult task than in the case of stoneflies and dragonflies.

My collections indicate that this is a midsummer species in northern Illinois. My bred specimen is dated June 22. None of the imagos in my collections shows an earlier date than this, but I have nymphs which are evidently near to transforming which were collected the first week of June. Imagos and subimagos of the collections are scattered all through July, but August 5th shows them most abundant. At about this date they were observed in swarms. By the end of August they are much less numerous, and I have no collections which are as late as September.

The subimago stage lasts 24 hours, and when the final emergence takes place the subimago alights on some object near the edge of the stream, where it transforms in less than a minute. The skin of the subimago remains attached to the bases of the setae of the imago and in this manner is carried out over the stream by the flying insect, where it is finally released after some minutes.

The adult of this species is briefly described in Eaton's Monograph, p.47. The habitat given there is Passaic river, Belleville, N. J. (Williamson); Winnipeg river (Say); Red river of the north and New York (Hagen). This seems to indicate a rather wide distribution for P. albus in the eastern and northern United States, but during the summer of 1903 I made collections from several of the boulder and limestone streams tributary to the Wabash in Indiana without obtaining a single specimen.

The nymph. Length, 14-16 mm.; antennae, 3.5-4 mm., and setae, 7-8 mm. Body depressed, widest across prothorax where the thin lateral margins project; eyes prominent and lateral; three somewhat crescent-shaped ocelli arranged in the form of a broad-based triangle; antennae many-jointed, bearing a whorl of minute bristles at the apical ends of the joints, the first two joints much stouter and the joints 4-8 decidedly shorter than the others, projecting beyond the mandibular tusks by a little less than half the length of the latter; mandibular tusks about 2.5 mm. long, stout at base, narrowing rather abruptly near the middle, the slender distal half tapering gradually to the acute, slightly out-curved tip; the basal half of tusk is thickly set with stout, acute spines, being less numerous on the slender distal portion, and entirely disappearing at about one third the distance from the tip; a few long hairs are borne on the outer side near the base; mandible stout, bearing two prominent tridentate fangs on its anterior surface nearly parallel with the distal half of the tusk, the middle tooth of each the longest; the endopodite arising from the base of the inner fang is inclined toward the molar surface, and bears a brush of long hairs on its inner side near the tip; the labrum is about half as long as broad, slightly emarginate in front, and thickly covered with fine hairs; maxillae somewhat slender, the outer basal portion fringed with stiff hairs; the maxillary palpi three-jointed besides the short pedicel, the second joint the shortest, the third joint about as long as the first and second together; outer side of third joint bearing a few long hairs, the stoutest ones being near the distal extremity, the

inner side covered with finer ones; the first joint fringed with short, stiff hairs on outer side only; the galea truncate at the tip, which is densely fringed with fine hairs, inner margin with fewer stout hairs, and the inner distal angle bearing a few stout spines; the labium with three-jointed palpi, the large ovate galeae with their tips projecting a little beyond the tips of the small lanceolate laciniae, both galeae and laciniae pilose.

Thorax depressed, widest across prothorax where the pronotum is continued laterally into a wide, thin margin, each margin ending anteriorally with a prominent acute process. The wing pads reach to about the base of the third abdominal segment. The legs are rather long, the foreleg being the longest; the fore femora stand almost at right angles to the long axis of the body, the middle femora at about 45°, and the hind femora closely appressed and nearly parallel with the body; the fore femur bears three or four rows of short spines on its anterior side, and a few stout hairs on its posterior side near the distal extremity; the fore tibia is long, and its inner side, as well as that of the tarsus, bears a fringe of long hairs; the former bears at its inner apical extremity a long, pointed process closely appressed against the inner side of the base of the tarsus; the inner sides of the fore tibia and tarsus both bear a number of small, sharp spines, being the most prominent on the tarsus and the apical process of the tibia.

Abdomen long and gradually tapering from about the third segment, tenth segment about as long as wide. Gills present on segments 1-7, each gill inserted on a lateral prominence bearing a minute tooth just in front of the gill base, the lateral prominence located just in front of the lateral, hinder angle of the segment, directed outward at an angle of about 45° to the long axis of the body; the first pair of gills small, single and spatulate, with minute fringes, are curved upward against the body and are nearly concealed beneath the edges of the wing pads; the other gills are double and shaped somewhat like a tuning-fork, the two branches linear acuminate, about equal in length, the outer branch bearing a rounded prominence at its basal end at the outer side; the respiratory filaments long, linear, about one third the length the gill lamina.

Setae about half the length of the body, plumose throughout the greater part of their length, and then tail-pointed, the median seta not so stout at the base as the others.

Colors of the body chiefly brown, amber on legs and thin margins of the body, an amber stripe along the dorsal median line of the abdomen; a brown band on each femur near the distal extremity, and a small brown blotch near the base of each.

NORTH AMERICAN HYDROPTILIDAE

BY KENNETH J. MORTON, F. E. S. (LONDON)

Some time ago Professor Betten sent to me several tubes containing a large number of examples of Hydroptilidae collected at Ithaca, N. Y. The examination of these has revealed quite an unexpected wealth of species, so many indeed that they should form a very satisfactory basis from which to start on the investigation of the North American forms comprised in this wonderful family. With the approval of Professor Needham and Professor Betten, I have here undertaken the attempt to describe the species found at Ithaca, and further additional material has been received from Illinois (Needham) and from New Mexico (Cockerell). A few specimens from the collection of the late lamented Mr. R. McLachlan, London, have also passed through my hands.

The condition of the material, preserved as it is in alcohol, puts a limitation on the character of the descriptions. The external facies of the perfect insects is practically lost, most of the hairy clothing having been rubbed off. To a great extent, therefore, the descriptions will be confined to the details of the ♂ genitalia, and even with regard to these I may add that much better preparations could have been made from dried specimens. After all the external facies affords very little aid in the determination of the species, although in collecting these insects in a restricted area one learns to know them by their appearance. In the meantime only the males are dealt with. The difficulty of associating with the respective males the true females of say six species of Hydroptila found in the same tube is one that will appeal to any one who has ever made the attempt. Eaton's memoir on the family (Trans. Ent. Soc. Lon., 1873, pp.125-150) was the first which dealt with these minute insect forms after the newer methods. McLachlan in his *Monographic Revision and Synopsis of the Trichoptera of the European Fauna* (London 1874-1880) gives a full general account of the family and good descriptions of the European species which were then known to him. As the best general account existing, McLachlan's work forms the basis for the present paper as regards

genera, etc. Since McLachlan's work appeared, much has been done towards obtaining a better knowledge of the family from different points of view, and our information is now much more detailed and exact with respect to the structure and morphological value of the so-called appendages, this improvement being largely due to the more extended use of microscopical preparations in studying these insects; and something has also been learned concerning the early stages of the lives of these tiny creatures which, as larvae, construct curious habitations of most diverse forms. As contributors to this knowledge may be mentioned the names of Klapálek, Ris, and the writer of the present notice.

Quoting from McLachlan (op. cit. p.503): "The minute insects comprised in this family may be justly termed Micro-Trichoptera, for the largest European form expands to no more than 10 mm., the smallest to only 3½ mm. Where they occur they usually swarm in great numbers, running with extreme rapidity, and very difficult to capture. Although they occasionally appear to delight in warm sunshine, they are more especially crepuscular or even nocturnal, and are attracted by light to such an extent that the walls and ceilings of rooms near water are often dotted with these dark atoms which have entered by open windows."

The largest measurements are attained in Agraylea and Allotrichia, no species of which is here described. The average expanse may be set down as 5-7 mm., the females as a rule being slightly larger than the males in a given locality.

The following table of the genera is taken from McLachlan's *Revision and Synopsis of European Trichoptera*, pp.504-5, with the addition of a new genus which is described on p.72.

A Wings broader, subobtuse, the posterior with no costal elevation or excision. (Neuration tolerably complete; spurs 0, 3, 4; ocelli present and distinct).....Agraylea

B Wings narrower, often acute or subacute; the posterior with a more or less decided costal elevation followed by an excision

a Spurs 0, 3, 4

b Ocelli present and distinct

c Neuration tolerably complete.....Allotrichia

cc Neuration less complete

d Wings scarcely acuminate.....Ithytrichia

dd Wings strongly acuminate.....Oxyethira

bb Ocelli absent (wings acuminate).....Orthotrichia

aa Spurs 0, 2, 4 (ocelli absent; wings scarcely acuminate; head with elevated lobes posteriorly) ..... Hydroptila
aaa Spurs 1, 2, 4 (ocelli present, wings acuminate, but scarcely acute) ..... Stactobia
aaaa Spurs 0, 2, 3 (ocelli present; wings acuminate) .. Neotrichia

In ignoring the three species referred to in Hagen's Synopsis, pp.27-45, I have followed a course far from satisfactory to myself, but the only one possible in the circumstances. Whether these species can now be satisfactorily elucidated depends altogether on the condition of the types.

Mr. McLachlan informs me that the Cyllene minutissimella of Chambers proved to be lepidopterous.

Unless otherwise stated the locality is Ithaca, N. Y.

Hydroptila

The genus Hydroptila, as at present constituted, contains many European species, and it is highly probable that the North American forms will prove to be more numerous. A glance at the figures of the appendages will however serve to show that the genus is, in respect of these important parts, far from homogeneous, and it will no doubt sooner or later be split up into two or more genera. The typical form may be taken as that represented by Hydroptila sparsa Curt., the nearest American form being H. consimilis. In this group there is a large somewhat campanulate dorsal plate, regarded by McLachlan as the united superior appendages.

1. Hydroptila consimilis n. sp.

The ♂ appendages as far as they can be described from the available specimens, are as follows: A large dorsal plate, convex above, notched on its outer margin, and the angles of the plate seen from above appear to be acutely produced, viewed from the side they are seen to be rounded. Side pieces of the last segment produced into somewhat curved subacute processes. Inferior appendages nearly parallel, blades slightly outturned at the tip which is pointed and blackened; the inner margin is oblique near the apex; a small wart on the inner margin before the apex; the outer or upper margin bears a row of short spinous hairs. The penis considerably below the apex has a strong curved acute process. Ventral lamina short.

This species, as has been indicated, is close to H. sparsa, but differs from that species in minor details, and particularly in the process on the penis, this process in H. sparsa being smaller and nearer the tip of the organ.

Ithaca, N. Y., and Belfrage, Texas.

2. Hydroptila delineatus n. sp.

This species has the lobes on the head enormously developed. The antennæ are about 31-jointed in the ♂.

The last dorsal segment appears to be deeply excised, the excision being followed by a large semitransparent plate difficult to separate from the basal portion of the appendages, but apparently having a small submarginal projection on either side of a larger median one, but the outline of the plate is rather uncertain. The inferior appendages are nearly parallel, the apex outturned and upturned; the apical portion seen from the side has the lower angle somewhat produced while the upper part of the apex forms a kind of knob which in some positions shows a slight angle on its anterior side. Arising from the upper side of these appendages is a long spirally curved acute process which winds itself round the under side of the apical lobe. On the outer (or lower) edge of the appendages, near their middle, is a slightly raised part bearing two or three spinous hairs. Ventral lamina short.

This species can be determined without difficulty from the ventral aspect of the appendages. It has no very near known ally.

3. Hydroptila spatulata n. sp.

The dorsal plate in the ♂ narrower than in consimilis, deeply notched in the posterior margin. Inferior appendages approximated at the base, slightly curved outwards and downwards, superior edge with a few spines; apex apparently scabrous. Side pieces of the last segment produced into rather long subacute processes. The penis, usually much exserted, with a flattened rounded apex, immediately below which is a small acute process placed at right angles. Ventral lamina very long and slender, slightly swollen at the apex when viewed from the side, the outer margin obliquely truncate, blackish and roughened. No very near ally known to me.

4. Hydroptila hamata n. sp.

The dorsal plate in the male is small, broadest in the middle, apex excised. Beneath it there is a small rounded penis-cover. The appendages are narrow, finger-shaped, aristate and widely divergent. Two strong hooks visible at the posterior margin of the last ventral plate or segment. The penis is very slender, curved at the apex and accompanied by a slender sheath of equal length. Ventral lamina very long; in lateral outline somewhat club-shaped, but lower margins oblique and minutely serrate.

This species is certainly near to the European f e m o r a l i s, but it differs especially in the form of the dorsal plate which in f e m o r a l i s is not notched and is boat-shaped in outline.

5. Hydroptila perdita n. sp.

Antennæ about 31-jointed in the ♂. The dorsal plate is large, rounded posteriorly, gradually becoming wider, the margins slightly retracted at the base, a small hollow looking patch near the apex. The inferior appendages subparallel blades, twisted outwards at the apex, which is obscurely bifid; scattered spinous hairs, particularly on external (superior) margin. Penis broad towards the base; in the exserted part tapering to a point, below which is a very strong curved acute process standing out strongly from the stem. Ventral lamina small.

ITHYTRICHIA

The typical forms of this genus are rather robust-looking insects bearing considerable resemblance to the species of H y d r o p t i l a, but they are at once distinguishable on account of their distinct ocelli and the absence of the elevated lobes on the posterior part of the head.

6. Ithytrichia clavata n. sp.

In the ♂ the antennae are about 24-jointed. The appendages may be described as follows: There appears to be a transparent dorsal plate with outer margin nearly semicircular in outline, but the plate is very difficult to separate from the other parts. There are very large side pieces of subtriangular form in the lateral aspect, blade-like if viewed from above, the apex down-turned and outturned rather acute and blackened at the extreme

tip. What may be termed the inferior appendages are not distinctly separated from the side pieces, and consist of a ventral plate apparently deeply slit; seen from the side the separate divisions of the plate appear as a rather long appendage slightly upturned and blackened at the point. The penis is club-shaped at the apex in one aspect; in another it is slightly excised at the apical margin and the club is hollow with a slender rod-like process lying within it. The penis seems to be formed of two joints, the apical probably capable of being partly retracted within the other; the latter joint is broad at the proximal part, but becomes constricted before the apex; a spiral sheath arises from about the middle of the organ. Beneath the penis is a transparent process out of which proceed two or more spines, and on either side of this central process are sometimes visible two minor ones.

There is some uncertainty about the form of the dorsal plate, but the true form of this will be readily ascertained from preparations made from fresh or dried specimens. Equally there is uncertainty about the cleavage of the ventral plate. These transparent membranous plates appear to suffer in form from immersion in alcohol.

A species closely allied to I. lamellaris of Europe, of whose appendages no adequate figures have so far, been published. In I. lamellaris in the part corresponding to that which is called above "inferior appendages" there is, I believe, no slit, although a long, narrow part where the membrane is thinner sometimes gives an illusory idea of a slit. In lamellaris the dorsal plate is produced in the centre with a blunt, slightly rounded lobe, while the process underneath the penis is about equal in breadth to the above-mentioned lobe, and instead of being simple as in clavata it is subdivided by an excision.

The larva referred to in *Psyche*, vol. ix, pp.375-8, is almost certainly that of the species just described. Whether the views expressed in that paper are well founded or not can only be determined by a more complete knowledge of the life history of the creature, the working out of which should be sufficiently attractive even if it does not result in the verification of Professor Needham's views.

The larva of Ithytrichia was originally discovered by a Mr Bolton of Birmingham who formerly supplied living microscopical material for students, and it was noticed by me in Ent. Mon. Mag., 1st series, vol. xxiv, p.171 (1888); it has also recently been described by Ulmer (Stett. Entomol. Zeit. 1902, p.364).

7. Ithytrichia confusa, n. sp.

Antennae about 28-jointed in the ♂, long and slender, none of the joints really submoniliform, entirely fuscous, save a few basal joints, which are pale yellow.

The last segment is open dorsally and within it lies a complicated organ represented in fig. 16. The appendages are closely approximated ventrally; in the side aspect they consist of a broad basal part, from the upper portion of which springs a long blade-like process, with rounded outer margin, beset within with numerous spines or spinous hairs. The outer margin of the basal part is beset with strong incurved teeth.

This species, which is very easy of identification, is referred provisionally to Ithytrichia, but the form of the appendages and the long slender antennae isolate it from the typical species of Ithytrichia. It is almost certain to be ultimately regarded as the type of a new genus.

Orthotrichia

The European species frequent both standing waters and rivers. They are insects which measure from 6-8 mm. in expanse of wing, and McLachlan says of O. angustella that its antennæ have about 39 joints in the ♂ and about 31 in the ♀. The most prominent features in the ♂ genitalia are as follows: Large dorsal plate which is more or less asymmetrical, usually notched in its outer margin and with stronger chitinized parts, which assume the form of hooks or strong teeth. The penis is of very great length, very slender, apparently divided into two parts, the apical part which probably forms about $\frac{1}{3}$ of the whole, being probably retractile (according to McLachlan, and I think he is correct). In Orthotrichia tetensii Kolbe, the side pieces of the last segment are asymmetrical, on one side being produced into a rather long, slightly curved sub-acute process, the other

into quite a short process, while the inferior appendages are much incurved, also asymmetrical, one of the appendages having a large ante-apical swelling or blunt tooth. In Orthotrichia angustella McL. the side pieces are apparently on much the same plan, but the appendages are strongly divergent.

8. Orthotrichia brachiata, n. sp.

Although but one poor specimen existed in the collection, I have no hesitation in referring this to the genus Orthtrichia on its general characters. As a species it is critically near O. angustella and the two are almost certainly representative of each other on the two continents. In O. brachiata the side pieces appear to be asymmetrical, but the specimen is somewhat damaged in this respect. The penis is typical of the genus and is notched at the apex. Alongside of it is a very strong acute sheath and under it a cover with rounded apex. The inferior appendages are very strongly divergent, aristate. Above these (according to what is found in O. angustella) there should be two spiniform processes slightly divergent and terminating in a hair, but in the specimen before me these can not be made out satisfactorily. The margin of the last ventral segment has a small chitinized median plate broader anteriorly and with excised fore and hind margins, the posterior projections each bearing a short bristle. The dorsal plate is as usual unequal on its two sides, but I can see no trace of teeth, although portions of the margin are more or less strongly chitinized.

It is to be regretted that the material is so unsatisfactory, but the figures should serve for identification.

Oxyethira

This genus, conspicuous on account of its narrow wings, has proved one of the most prolific of species in the European fauna. No estimates can be placed on the number of species that may eventually be found in North America; the possibilities are boundless.

9. Oxyethira coercens, n. sp.

Antennæ in the ♂ about 31-jointed.

The last segment dorsally is semicircularly excised when viewed from above; seen from the side the edges are strongly

toothed. The ventral plate, if viewed from the side, is in the form of a strong claw with serrate margin; from beneath, its margin is excised rather deeply, and each of the side lobes has about three teeth. On either side the apex of a blackish rod is usually visible. The penis has the apex much dilated and armed with two or three teeth.

This species, which belongs to the same group as the European O. frici Klap., should be very easily recognized from the ventral plate.

10. Oxyethira viminalis, n. sp.

The margin of the last dorsal segment is slightly and simply excised. Beneath, the margins of the segment recede and form a deep excision. The ventral plate has the margin nearly straight, and above it are two blackish appendages—no doubt the homologues of the hooks which lie above the ventral plate in several European forms. The penis is large, and with its sheaths forms a very complicate structure; the apex, however, is simple. The only other appendages visible are a pair of lateral rods.

Described with great hesitation from a single ♂ from Ithaca, but afterwards fully verified from further material from Prof. Needham (Lake Forest, 15 Oct. 1902).

11. Oxyethira dualis

In this species the appendages are very simple; seen from above the penultimate segment is deeply excised; from the same point of view is visible a quadrate penis cover, the posterior margin of which has two slight excisions. From beneath is seen the simple ventral plate, almost straight in its posterior outline, the hind angles slightly oblique; the plate is rather broader at its base and on each lateral margin is a faint angle. The apex of the penis has an elongate swollen part, probably exaggerated in figs. 37 and 38, through the presence of some extraneous matter; after preparation this part had the appearance of having two slightly chitinized straight rods and a sickle-shaped one.

1 ♂ Las Vegas, New Mexico. (Cockerell.)

Another larger female, probably also an Oxyethira, was in the sending from New Mexico, but I can say nothing definite about it in the absence of the ♂.

Neotrichia, nov. gen.

Spurs 0, 2, 3. Ocelli present. Head posteriorly with two large pyriform warts; disc elevated with a median longitudinal line. Antennæ with 18-19 joints (probably in both sexes), joints shorter and more submoniliform in the ♀; rather stout, basal joint moderately long and slightly curved, second joint somewhat shorter, the four following subequal and cylindrical, the remainder submoniliform. (Palpi uncertain from the material in hand.) Legs long and slender. Neuration apparently simpler than in any of the other known genera. (Compare the figures.)

12. Neotrichia collata n. sp.

In the ♂ the apex of the abdomen may be described as follows: Above there is a semitransparent transverse plate, at either side of which are two rather longer thin processes which seem to be slightly out-turned at the apex. There are also semitransparent side pieces rather slender and slightly curved. The inferior appendages consist of two parallel contiguous processes which at the apex on their inner edges are obliquely truncate and bear one or two teeth. The penis in its apical portion consists of two closely-lying parts of nearly equal length, slightly hooked at the tips.

A minute and exceedingly interesting form. The figures were rather difficult to obtain from the material received, but the important characters are set forth and will serve sufficiently for identification.

From New Mexico a large number of interesting cases belonging to two or probably three species have been sent. One is a veritable Oxyethira, while the others belong probably to Hydroptila, but I am not sure whether the differences shown by some of the cases are due to individual variation or point to the presence of two species.

SUPPLEMENTARY NOTE

In the interval that has elapsed since the above paper was written, Mr. Nathan Banks has published two papers which contain references to North American Hydroptilidae (two species of Hydroptilidæ, Ent. News, April '04, p.116; and A List of Neuropteroid insects, exclusive of Odonata, from the vicinity of Washington, D. C., Proc. Ent. Soc. Wash. Vol. vi, No. 4, pp.215-6). These may give rise to questions of synonymy, but at

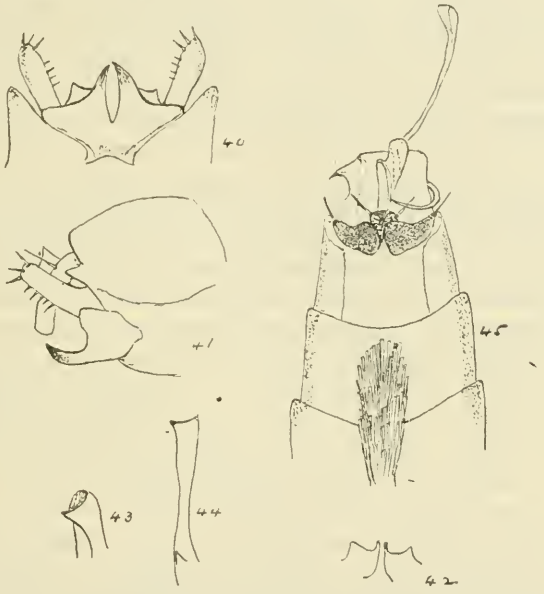

Fig. 15 Hydroptilid structures: Agraylea multipunctata; 40, apex of abdomen from beneath, 41, same from side, 42, triangular pieces from side, 43, same when much exserted, 44, ventral lamina; Orthotrichia americana (?) 45, apex of abdomen from beneath.

the moment I am unable to deal with the subject which I think may be safely left to be cleared up by American students.

In the same interval some further material has come to hand from Professor Needham and Professor Betten, but this has been only partially examined. It includes an Agraylea which appears to be the same as the European A. multipunctata, and an Orthotrichia which I had described under the name of O. cristata but which may be O. americana, Banks. There is also another good species of Hydroptila, but the material is hardly sufficient for description.

Professor Needham bred the Agraylea and sent me the larva and cases. The metamorphoses of Agraylea and many other European forms have been described recently in an admirable way by Herr A. J. Silfvenius of Helsingfors.

Agraylea multipunctata Curt.

McLachlan, Rev. & Synopsis, p.506, describes the species as follows:

Antennæ blackish fuscous. Body blackish fuscous; abdomen greenish in life; blackish in dry examples with pale lateral lines; the ventral surface clothed with silky yellowish hairs. Head and pronotum clothed with greyish yellow hairs. Legs subtestaceous with fuscous femora; clothed with pale hairs. Anterior wings ordinarily blackish, with numerous distinct golden-yellow markings, mostly forming spots, but usually there is also a long and broad space near the apex of the costal margin, about two elongate spaces on the inner margin, and two or three apical spots extending into the fringes which are otherwise dark (but these markings are very variable; individuals occur in which they are entirely absent, the wings then being wholly blackish, or in which they invade the whole wing, obliterating the dark ground and causing the insect to appear pale cinereous). Posterior wings cinereous grey, with concolorous, slightly iridescent fringes.

In the ♂ there appears to be a bilobed shining yellowish plate under the margin of the last dorsal segment. Superior (intermediate?) appendages in the form of two contiguous yellowish bands, very strongly curved downwards; from between them escapes the penis, which is dark, straight, updirected, its apex dilated and truncate. Inferior appendages, viewed ventrally, very distant, upcurved, yellowish, subcylindrical, but they are apparently connected with two upcurved contiguous median processes, seen from the middle of the ventral margin, more slender than the appendages and blackish at the tips; internally, on either side of these, is a triangular piece. Lobe of the antepenultimate ventral segment long, *flattened and adpressed dilated gradually to the apex*, which is shallowly excised and narrowly blackish; the colour otherwise testaceous; at the base of this lobe is a subtriangular blunt tooth.

In the ♀ the abdomen ends in a stout upcurved ovipositor, and there is the usual small sharp tooth on the antepenultimate ventral segment.

Expanse 7½-9 mm.

The foregoing description was made no doubt entirely from dry examples. The words italicized and the stouter form of the inferior appendages are almost the only characters which served to separate the closely allied A. cognatella, a very critical species regarding which I have some doubt.

The superior (intermediate?) appendages of McLachlan, described by him as in the form of two contiguous yellowish bands very strongly curved downward, appear to be separate at the base only, the downturned tip being rounded. Between the divided base escapes the penis, which is not shown in the figures here. The construction of the socalled triangular pieces is very peculiar and their appearance depends much on the degree to which they are exserted.

The North American insect is practically identical with the European; the only difference appears to be in the upcurved contiguous median processes which are probably rather shorter and stouter in the American form. The latter was bred by Needham at Lake Forest in June, and he sent the same species from Chicopee Mass. (23 April '03). It will probably prove to be common in the Northern States.

Orthotrichia americana Banks ? (Ent. News 1904, p.116)

O. cristata Morton, U. S.

The dorsal plate in the ♂ is almost entire in its outer edge; from the one side, on the upper surface, arises a short hook, while on the other side, nearer the middle, arises a long, slender, much-curved acute process bent strongly inwards under the plate itself. The last ventral segment terminates in two separate blackish plates which are broadest where they approach each other, narrowing outwards, their apices bearing a spine; between these plates is a black appendage which seen from the side is hook-shaped and bears two spines. The seventh ventral segment with a process covered with strong thick blunt hairs; the sixth segment with a small tooth.

Lake Forest, Ill. (Needham).

The process on the seventh ventral segment is very similar to that found in the European O. tetensii.

AQUATIC NEMATOCEROUS DIPTERA II

Chironomidae

BY OSKAR AUGUSTUS JOHANNSEN

The present work forms a continuation of the paper entitled "Aquatic Nematocerous Diptera," published in bulletin 68 of the New York State Museum (1903). In that paper the Blepharoceridae, Simuliidae, Culicidae, and the Dixidae were treated. In this paper the Chironomidae will be considered, the classification reviewed, the chironomid genera of the world described and discussed, and finally descriptions given of the imagoes of all known North American species except those belonging to the group Ceratopogon (sens. lat.). Descriptions will also be given of all larvae and pupae as far as known. The bulk of the material studied was collected in New York, but many specimens were obtained from the Mississippi valley, Rocky mountain and Pacific coast states. In drawing up the descriptions of the species upward of 5000 pinned specimens and much alcoholic material was studied. In order to save space the references to works of authors are abbreviated, only the author's name followed by a date is given, the complete reference being given in the bibliography in the back of the book. The study upon this family of flies was begun in the spring of 1901 and was continued throughout four seasons. The work was done in the entomological laboratory of Cornell university under the direction of Professor J. H. Comstock, to whom I wish to express my thanks for advice in the preparation of this work. I am also under obligations to Professor Kellogg of Leland Stanford jr. university, Professor C. O. Houghton of Delaware agricultural college, Professor Aldrich of Idaho, Mr. A. L. Melander of Washington State, and Doctors MacGillivray and Riley of the instructing staff of Cornell university; and especially to Professor J. G. Needham of Lake Forest university for specimens and many favors.

The family of the Chironomidae or midges comprises a large number of very delicate, and often minute flies, of which over 800 species are known throughout the world. They resemble mosquitoes in some respects, but are usually more delicate, and

may be distinguished from them by their wing venation. These midges are often seen, especially in early spring or autumn, in immense swarms dancing in the air, and are frequently to be found at these seasons upon the windows of dwellings where they are often, perhaps usually, mistaken for mosquitoes.

Professor Williston relates (1896) that over meadows in the Rocky mountains he has seen them rise at nightfall in most incredible numbers, producing a humming noise like that of a distant waterfall, and audible for a considerable distance. Most of the species are inoffensive or actually beneficial as scavengers. The group Ceratopogon, however, forms an exception, some members of which, known as sandflies, or punkies, have the power of sucking blood, and are particularly troublesome in the mountains, along streams, and at the seashore. The Chironomidae are very widely distributed, being apparently as prevalent and as numerous in the frigid as in the torrid zone. There are about 500 European species, many of which were described by Zetterstedt, from Sweden and Lapland. Of the species hitherto described from North America over one third are from Alaska, Greenland and Hudson bay territory. A surprisingly large number of species are common to both Europe and North America. When the fauna of Asia, Africa and South America is as well known the total number of species will doubtless be increased many fold.

Geological distribution

One would scarcely expect the delicate, minute flies of this family to be preserved from mesozoic times, yet they seem to be not altogether unknown. Two species referred to Macropeza are figured, one by Geinitz from the Lias of Dobbertin and one by Brodie from the English Purbecks; two other obscure forms from the English Purbecks are figured under the name of Chironomus; and Corethrium pertinax and Cecidomium grandaevum of Westwood, from the same beds, appear to belong to this family rather than to the Cecidomyiidae or Culicidae. Rhyphus priscus Brodie, from the English Purbecks, also probably belongs here and not to the Rhyphidae.

The family is very abundant in amber, Loew having found seven species of Tanypus, more than forty of Chironomus and twenty-six of Ceratopogon. Giebel also describes two species of Chironomus and one of Ceratopogon in amber, and these genera had previously been recognized as occurring there by Burmeister, Erickson and others. Duisberg also records a peculiar genus, Sendelia, from the same. But the occurrence of the family in a fossil state is not confined to amber; thirteen species of Chironomus have been described from Rott, Oeningen, Rodoboj, and Utah, and the genus has been recognized also in Wyoming, while numerous pupae distinguishable as belonging to several species are recorded by Heyden from Rott. Ceratopogon has also a species at Rott, and it has been recognized at Aix and in Sicilian amber. Numerous specimens of the family occur at Florissant, but they are usually in very poor condition; they have also occurred in the British Columbian tertiaries. Scudder (1886).

Economic importance

The only function of the imago of the Chiromomid, at least in the group Chironomus, and perhaps Tanypus also, is that of reproduction. Miall and Hammond (1900) say, "It is evident that Chironomus does not feed in the winged state. The mouth parts, though of elaborate structure, are never used in feeding, and the alimentary canal of the fly is empty, except for a greenish fluid, which fills the stomach of the pupa and newly hatched fly. . . . The larvae of Chironomus feed on dead leaves and other vegetable refuse. Microscopic examination of the contents of the stomach reveals a blackish mass of vegetable fragments, besides Diatoms, Infusoria, eggs of other aquatic animals and grains of sand."

Some species of the group Ceratopogon are blood suckers and their mouth parts as figured by Professor Kellogg (1899) seem admirably adapted to this function.

The larvae and pupae of the Chironomidae are of much importance as fish-food. Professor Needham (1903, p.204) mentions the fact that large numbers of the larvae of a species of Chironomus were taken from the stomachs of brook trout,

proving that these fish live almost exclusively upon "bloodworms," at certain seasons at least. Garman (1888) says: "Probably no other one genus of insect constitutes as important an item in the food of as large a number of fishes." While Forbes (1877) in giving a list of the organisms which form food of fishes records Chironomidae as occurring in the stomachs of many species.

Enemies

Besides the fish which devour vast numbers of Chironomid larvae, the nymphs of dragonflies, caddis worms, Perla, Sialis, beetle and other predaceous larvae constantly prey upon them; while the adults are eaten by dragonflies, by the net-winged midges (Blepharoceridae) and other predaceous insects. In a swarm of these midges very often one also sees a number of danceflies (Empids) constantly seeking victims.

Methods of capturing, rearing and mounting

Sweeping the low brush, rank grass, and herbage along the banks of ponds and streams is the usual way of capturing these flies, and often in a favorable location hundreds may be caught in a few hours; but the most satisfactory manner of catching is by means of a cyanide traplantern, such as is described by Professor Needham (1901, p.398). By means of it several thousand specimens may be taken in a single night. The most favorable time for setting the lantern is a sultry, cloudy night, during the summer or spring; and the most favorable location is near the bank of a pond or creek.

The larvae and pupae and sometimes the eggs also may be scooped from the bottom of the pond by means of a small coffee-strainer net; or swept by means of a brush into a cloth sagnet from the surface of the rocks at the bottom of the shallow creek as described by Professor Needham (1899, p.5). From thence they are transferred to jelly tumblers, or for those forms which require rapidly flowing water to a jar from which the water is drawn as rapidly as it enters by means of a continuous siphon as described by Professor Comstock in "Insect Life," p.330. If the larva is nearly full fed, but a short time will be required for it to transform. If the specimens are still quite small, some

dead leaves and rubbish may be put in the glass for them to feed upon. The larvae of Chironomus usually hide themselves from view, and in the mud and debris form tubes which open at the surface. When placed in a jar their chief anxiety is to bury themselves in the mud, and very soon they will gather bits of dead leaves and particles of sand about them, binding them together with viscid threads passed out of the mouth, and in a short time will be completely concealed in a rough tube. These tubes are frequently seen upon the surface of dead leaves, on stones, sticks, etc. One species is known to be a leaf miner (Pettit, 1900). The larvae of species belonging to the groups Ceratopogon and Tanypus usually do not form tubes, but remain free. Specimens captured in the fall may live all winter and not transform until spring. Some specimens of Ceratopogon taken by the writer in September lived until the following May in the larval stage, and it is probable that they live thus nearly a year. The larvae may be found all the year around, while the adults are common excepting in the dead of winter, and a few specimens may be found even at that season.

The larvae are best preserved in alcohol, either first killing them in hot water, or placing directly in the alcohol. If any peculiarity of color marking is observed it should first be noted, as the spirits soon remove much of the pigment. The adult should be mounted with great care, either upon an elbow pin (MacGillivray, 1903b), or upon a minutien nadel, a short and very slender headless pin, thrust through a small piece of cork or pith and then into the under side of the thorax of the fly. Through the other end of the cork an ordinary insect pin is placed, and the specimen is then ready for the cabinet. It is also very desirable to preserve some specimens of each species in alcohol, or better still, in a mixture of formaldehyde and glycerine. The latter preserves the original colors quite well, especially if kept in the dark. These specimens should be put in very small vials and should, of course, bear the same number label as the pinned specimen. The fore tarsi of the genus Chironomus are very easily broken off, and therefore it is quite necessary that great care should be observed in preserving them since their presence is necessary in the determination of

some of the species. It is the practice of the writer to remove one wing and all the legs from one side of at least one specimen of each species and to mount them (preferably dry) upon a slide; this method allows of ready measurement and comparison.

Characteristics of egg, larva, pupa, and adult

The adults may be characterized as follows: More or less mosquito like in form, seldom reaching ten millimeters in length. The head is small, somewhat compressed, palpi usually four-jointed; proboscis short; antennae of variable length, from six to fifteen jointed; the first joint disk-like, the last one elongated, the male antennae usually plumose. Eyes reniform or oval; ocelli rudimentary or wanting. Thorax highly arched, frequently projecting over the head, without transverse suture; scutellum small and hemispherical; metathorax well-developed. Abdomen long and slender, eight-jointed, the hypopygium projecting forceps-like; ovipositor but little developed. Legs usually long and slender; coxae moderately long; tarsi frequently very long. Wings either bare or hairy; the veins of the costal margin being stout and in marked contrast with those in the other part of the wing, which appear to be fading out. Venation variable. The larvae usually have blood or tracheal gills, and are soft-skinned and worm-like. The pupae are free, some are active and resemble Culex, others float upon the surface of the water and still others remain at the bottom of the pond until ready to emerge.

The flies with which they might be confused are the crane flies and the mosquitoes. The former (Tipulids) are usually larger, have proportionately longer legs, have more numerous and more distinct wing-veins, and have a V-shaped suture upon the dorsum of the thorax. The latter (Culicids) have scales upon the wing, and all, excepting the subfamily Corethrinae, have an elongate biting proboscis. The adults of the genus Chironomus have a peculiar habit of holding their fore legs high above the surface upon which they stand, while the mosquitoes usually hold up their hind legs.

There is one other family of flies, the Stenoxenidae, which must be distinguished from the Chironomidae. This

peculiar family has but a single genus, a single species, and is represented by but a single specimen, which is now in the United States National Museum. This family will fall in the couplet with the Chironomidae in the key given by Comstock (1895), and by Williston (1896), but differs from all the members of this family by its peculiar wing venation (pl.35, fig.29). The description of the family was first given by Mr. Coquillett (1899a).

The eggs

The eggs of most of the Chironomidae are deposited in water; some species in swift flowing water, others in sea or lake water, while most of them lay them in stagnant pools or ponds, or in slow flowing streams. The eggs of a few species are deposited in bark, in manure, and in debris. Some species lay them in strings resembling somewhat a minature string of toad's eggs; while others lay them in clumps. The eggs themselves are elongate, cigar-shaped, usually pointed at each end. They hatch in a few days.

The larvae

The larvae are worm-like, but vary somewhat in form with the different genera. Most of them are aquatic, while a few live in the earth, in manure, or under bark (pl.16, fig.4; pl.17, figs.1 and 4; pl.19, fig.9).

Excepting some of the Ceratopogon they are provided with both thoracic and anal prolegs, and move by creeping in a manner somewhat like a geometer larva, without, however, such regularity, nor does the middle section hump up, but loops irregularly to one side or the other. Many species are blood-red in color, and hence are frequently known as blood-worms. They have a distinct head with well-formed labrum, labium, epipharynx, hypopharynx, mandibles and maxillae, the mandibles moving in oblique planes. The body is distinctly segmented, usually with twelve joints besides the head, the three thoracic segments being but little thicker than those of the abdomen. The twelfth segment is provided with a pair of prolegs, some caudal setae and blood gills: sometimes there are two pairs of conspicuous blood gills upon the ventral surface of the eleventh segment also. The

terrestrial larvae of Ceratopogon have prominent spines and setae upon the body, while the aquatic forms are nearly devoid of them (pl. 17, figs.1 and 4). The aquatic larvae of Ceratopogon have no prolegs and the body is very slender and snake-like. The larvae can exist at great depths, and have been fished up from the bottom of deep lakes. They have been found in salt water (Packard, '70a).

The pupae

The pupae of Chironomus are frequently found in the old larval cases; others swim very freely near or at the surface after the fashion of a pollywog. The pupa of Tanypus is active and resembles that of Culex in form and habit. The pupa of the aquatic Ceratopogon is more elongate than Tanypus, is not active, and floats, nearly motionless, in a vertical position. All of the pupae have an enlarged thorax and usually a pair of respiratory tubes or filaments, while the caudal end is somewhat broadened and paddle-like or prolonged into two-pointed lobes, with ciliate margin.

The imagines

To the imaginal characters of the family already given the following may be appended:

The head is small, spheroidal, flattened where it joins the thorax, in some genera somewhat hollowed out between the eyes. The compound eyes are large, with conspicuous facets and distinctly separated from each other. They are kidney-shaped (reniform); that is, hollowed out around the base of the antennae. The ocelli are wanting. The front, the space between the eyes, is limited by the upper margin of the head and a line drawn through the root of the antennae. The vertex is the uppermost part of the front, near the margin of the occiput.

The face is the portion below the antennae, which is prolonged more or less downward to form the proboscis. The oral margin and an indefinite space immediately contiguous to it is called the epistoma or peristoma. The epistoma is usually convex, provided with setae or sensory hairs. The maxillary palpi are the slender, usually four-jointed appendages, the most conspicuous of the mouth parts. The labrum, hypopharynx and labium differ with

the different genera. In Chironomus and allied genera there is no trace of mandibles. In Ceratopogon the mouth parts are fitted for piercing. For homologies of the mouth parts, see Kellogg's papers in Psyche, 1899. The antennae or feelers are variable in form and number of joints; the first visible joint (called 2d joint by Miall and Hammond 1900) is usually enlarged, followed by a second which is sometimes also somewhat enlarged, these two being called the scape. These are always more or less differentiated from the remainder, which constitute the flagellum. In the male the joints of the flagellum are usually provided with long hairs. The first joint of Miall and Hammond (1900) is the extremely short hidden one, which is sunk in the head, and almost entirely occupied by the muscles which move the antennae to and fro. The next joint, the large one, exhibits a peculiar structure, which is believed to serve for the perception of sound. (M. and H. 1900, and Mayer 1874.) The head is connected with the thorax by a neck, whose cuticle is membranous.

The thorax is composed of three parts, the prothorax, the mesothorax and metathorax. The prothorax is quite narrow, forming a rounded collar back of the neck, within which are the muscles of the foreleg. On the dorsal surface it appears as a narrow band with a median incisure and suture. The humerus or humeral callus belongs also to the prothorax according to Miall and Hammond (1900). It is called the paratreme by Lowne. The mesothorax is very large; it is highly arched, and in some it projects somewhat over the head. On its fore edge is the anterior thoracic spiracle. The upper or dorsal surface of the mesothorax is often called the mesonotum, and it has attached to it at its posterior margin, and cut off from it by an impressed line, the scutellum, a small, semioval body, which really belongs to the mesothorax (see pl.31, fig.16, Chasmatonotus). The wings are attached to each side of and just below the scutellum. Behind and beneath the scutellum is a smooth and rather prominent oval-arched portion, the metanotum or upper portion of the metathorax (or post scutellum of Miall and Hammond 1900). Below and between the fore and middle legs is a very prominent hemispherical part (especially in Chironomus), the mesosternum. The sides of the body in front of the wings are called the pleura, and the under surface of

the thorax as a whole is called the sternum or pectus. The intermediate legs are attached to the hind part of the mesosternum by oval sockets. The metathorax is much smaller than the mesothorax. Its dorsal surface, called the metanotum, has already been mentioned. On the side is the posterior thoracic spiracle, and above it is the haltere (balancer or poiser) the rudimentary hind wing, a slender organ with a dilated head. The ventral surface of the metathorax is short and narrow and is largely occupied by the insertion of the hind legs.

The abdomen is composed of nine segments more or less closely fused together. In the male especially it is long and slender and terminates with the genitalia. The genitalia varies greatly with the different genera (pls. 32, 33). The anus opens on the dorsal surface of the ninth segment. The under surface of abdomen is sometimes called the venter.

The three pairs of legs are long and slender, especially so in Chironomus, are attached to the prothorax, mesothorax and metathorax, and are called respectively the front, middle and hind pairs. The older writers who used the Latin terminology spoke of the forelegs as pedes antici, the middle legs as pedes medii, and the hind legs, pedes postici. When they spoke of the fore and middle legs together they called them pedes anteriores. Some writers still use the term anterior legs for fore and middle pairs, and posterior legs for the middle and hind pairs. The coxa is the part attaching the leg proper to the thorax; while the trochanter is the short, small, ring-like portion between the femur and coxa. The femur or thigh is the stoutest portion of the leg; the tibia is the next part succeeding the femur. The tarsus is the distal division of the leg and is composed of five joints, of which the first, that next the tibia, is called the metatarsus. The ungues or claws are two hooklets on the underside of the last tarsal joint. In most genera these are simple, but a few have uniserrate or bifid claws. The pulvilli, two pad-like fleshy cushions attached to the last joint of the tarsus below the claws, are often present. The empodium is a median appendage between the claws, and is usually present also. The usual shape in this family is that of a sickle-shaped process, pectinate on the convex side.

The wings are usually rather slender and delicate, with the anterior veins (those nearest the costal border) rather stout, while the posterior veins are usually very delicate and indistinct. The surface of the wing is delicately hairy in a number of species, though the majority have bare wings.

Below is given the Comstock-Needham terminology of wing venation as used in this paper, together with the equivalent terms of the Schinerian system as applied with but slight modifications to the Nematocera generally:

Comstock—Needham		Schinerian
Costa (C)	=	Costa
Subcosta (Sc)	=	Auxiliary
Radius (R_1)	=	First longitudinal
R_{2+3}	=	Second "
R_{4+5}	=	Third "
Media (M)	=	Fourth "
Cubitus (Cu)	=	Fifth "
Anal (A)	=	Sixth "

The costa ends at or before the tip of the wing in all the genera; the subcosta, though sometimes rather indistinct, is usually present; the radius is stout and well developed, and usually with two or three branches, R_2 in some genera appearing like a crossvein; the media usually present and always simple; the cubitus is nearly always two-branched; anal vein usually present though delicate. Compare pl.17, figs.13-16, pls.27 to 31. The halteres, the slender organs with knobbed ends which are supposed to be the rudimentary second pair of wings, are rarely wanting.

For a description of the internal anatomy of both larva and imago the reader is referred to Miall and Hammond's work on the harlequin fly (1900).

A large number of genera have been erected to contain the species of the world. Of these some may be placed as the synonyms of others, leaving still over 40 valid genera. In order to facilitate identification a key to the North American genera is offered besides the more general one for the genera of the world.

KEYS TO GENERA OF THE CHIRONOMIDAE

Larvae

a Abdomen with prominent rounded elevations or cushions, with rows of teeth on the inferior (anterior) angles of the segments
13. Psamathiomyia

aa Abdominal segments without these cushions

b Aquatic footless snake-like larva, or terrestrial larva with thoracic and anal feet, and many setae and bristles on body segments, pl.17, figs. 1 and 4.....(*Group Ceratopogon*)

bb Not as above

c With retractile antennae, the latter often quite long, long stilt-like legs, the caudal tufts of hair mounted on cylindrical processes, pl.19, fig.9.....(*Group Tanypus*)

cc Not with all the above characters

d With the two caudal hair tufts mounted on cylindrical projections

e With six seta-like processes on each of the caudal projections, three long and three short. Eyes prominent, round, on anterior angles of the head, pl.34, figs. 21, 22, 23 (European)
26. Wulpiella

ee Eyes not on anterior angles of head

f With blood gills on venter of eleventh segment
31. Hydrobaenus

ff With blood gills only at end of twelfth segment
44. Metriocnemus

dd Caudal tufts on small rounded papillae

e Antennae elongate, at least one half and often as long or longer than the head; compare also pl.20, fig.10

f With two anal blood gills, pl.36, figs. 1, 2, 3
25. Corynoneura (lemna)

ff With four anal blood gills; antennae mounted on basal prominence, pl.26, figs. 5, 8.....42. Tanytarsus

ee Antennae short

f Larvae usually blood red; eleventh body segment with two pairs of blood gills, pl.15, fig.4..38. Chironomus (pt.)

ff Larvae greenish, yellowish, or whitish

g The maxiliary palpus usually noticeably longer than broad. Larva in pools, pond water, or slow streams, pl.23, figs. 3 and 16.....38. Chironomus (pt.)

gg Palpus about as long as broad. pl.24, figs. 5, 12, 20

h Full-grown larva not over 6 mm. long, green or bluish-green in color. Anterior abdominal segments of greater diameter than the posterior ones. Mandibles often transversely wrinkled; the anterior prolegs usually with pectinate setae { 39. Cricotopus / 41. Orthocladius

hh Full-grown larva over 6 mm. in length; mandible not transversely wrinkled

i Labium with its teeth rounded, pl.20, fig.9

35. Diamesa waltlii.[1]

ii Labium with its middle tooth broadly truncate

37. Thalassomyia fusca

NOTE.—See addenda for several anomalous species.

Pupae

a Pupa floats nearly motionless in a vertical position at the surface of the water, pl.17, fig.11.....(*Group Ceratopogon*)

aa Pupa not as above

b Active pupa swimming with a jerking motion in the water like a culex pupa, pl.19, fig.8.....(*Group Tanypus*)

bb Not culexlike

c With long setae or filaments at caudal end

d Caudal filaments very numerous and forming a caudal paddle, pl.22, fig.14, and pl.26, fig.15

e Thoracic respiratory organs a tuft of filaments, pl.16, fig.2

38. Chironomus

ee Respiratory organs consisting of a main shaft with lateral hairs or setae. Abdomen with setae and bristles.

42. Tanytarsus

dd Caudal appendage with long setae

e With eight long setae on each side of caudal appendage, pl.36, figs. 4 and 5.....25. Corynoneura lemnae

ee With a tuft of long setae on each side; thoracic respiratory organ a simple finger-like process, pl.34, figs. 5 and 8

31. Hydrobaenus

cc With three or four pairs of short setae, a plate-like sucker or with a paddle

d Plate-like sucker at caudal end, pl.34, figs. 14 and 15

29. Telmatogeton (St Paulii)

dd With two or three pairs of short setae or with paddle

e Without thoracic respiratory tubes. Abdominal segments with a fringe of conspicuous spines or setae or projections, pl.48, fig.13, and pl.50, fig.10 in Bul. 68 N. Y. State Museum, 1903

{35. Diamesa
37. Thalassomyia
44. Metriocnemus

ee With respiratory tubes. Abdominal segments usually without a fringe of prominent setae, pl.24, fig.24, also pl.24, figs. 13, 14, 15

{39. Cricotopus
41. Orthocladius

[1]The larva of Thalassomyia congregata (an European species) has a labium like Diamesa waltlii.

Imagines

NOTE.—In counting the antennal joints the large basal joint is included, but not the hidden first joint.

a Wings absent or rudimentary
b Wings reduced to mere vestiges, legs short and not slender, antenna with seven joints, mouth parts rudimentary, pl.36, fig.13, female
14. Clunio
bb Rudimentary wings reaching at least to the end of the first abdominal segment
c Halteres wanting, wings in the form of a flattened racket, tarsal claws with a little subapical tooth. Palpi four-jointed; antenna five (?) jointed.....10. Belgica
cc Halteres distinct
d Palpi four-jointed; antenna of the female four-jointed, of the male six-jointed, pl.35, figs. 16, 21, 22.....11. Eretmoptera
dd Palpi two-jointed; antenna of the female six-jointed
e Second joint of antenna like those following, monilliform, pl.37, figs. 5, 6, 7.....12. Halirytus
ee Second joint longer than those following; male antenna also with six joints, pl.35, figs. 4 to 9...13. Psamathiomyia
aa Wings present
b The M-Cu crossvein present (i. e., cell M closed by a vein), pl.37, fig.24
c Antenna with twelve or more joints
d Antenna with fourteen joints usually plumose; fourth tarsal joint usually shorter than the fifth; wing bare, pl.30, fig.13, male
35. Diamesa
dd Not as above
e Antennae with fifteen joints both in male and female; plumose in the former; the vein M simple, pl.27, figs. 1 to 15
(*Group Tanypus*)
f Wing bare
g Fork of the cubitus petiolate.....15. Procladius
gg Fork of cubitus proximad of crossvein
16. Anatopynia n. gen.
ff Wing pubescent
g Fork of cubitus proximad of crossvein
h Antennae of male and female each with fifteen joints, R_2 and R_3 distinct.....17. Ablabesmyia n. gen.
hh Antennae of female with twelve joints, the male with fifteen joints, R_3 indistinct (Australian genus)
18. Isoplastus
gg Fork of cubitus petiolate.....19. Tanypus
ee Antennae with twelve or fourteen joints; wings hairy; cubitus not forked; anterior crossvein long and very oblique, pl.37, fig.16 .....20. Pentaneura
cc Antennae with less than ten joints
d Crossvein near basal third of wing, pl.37, fig.11. Antennae about eight-jointed (Chile).....21. Podonomus

dd Crossveins near middle of wing

e Palpi six-jointed; antennae seven-jointed; wing venation as shown on pl.37, fig.21 (Chile).....22. Heptagyia

ee Palpi four-jointed

f Antennae of female seven or eight jointed; male antennae fourteen-jointed; wing bare.....35. Diamesa

ff Antennae of female with eight joints, the male with nine, short-haired .....36. Eutanypus

According to the description the female of Eutanypus does not seem to differ from the female of Diamesa.

bb The M-Cu crossvein absent

c Wing with four or five very indistinct longitudinal veins; wing club-shaped, the anterior margin with a long curved seta, the antenna with about twelve joints.....23. Corynocera

cc Wing margin without a long curved seta

d Probocis and palpi rudimentary; abdomen shorter than the thorax (female apterous).....14. Clunio

dd Palpi not rudimentary

e Antennae with not more than ten joints

f Antennae six-jointed

g The R–M crossvein, if present, at the basal quarter of the wing

h The R–M crossvein near basal quarter of the wing, pl.37, fig.13 (Chile).....24. Spaniotoma

hh The R–M crossvein coalescent with the longitudinal veins; wing club-shaped; the anterior cells thickened, pl.36, fig.7.....25. Corynoneura

gg The R–M crossvein near the middle of the wing

h Wings hairy; antennae with the four intermediate joints verticillate with very long hairs; male unknown (Europe), pl.34, fig.20.....26. Wulpiella

hh Wings with margin ciliated; antennae with sparse verticils of spreading hairs (Kerguelen Island), pl.37, fig.1 .....27. Limnophyes

ff Antennae with seven to ten joints

g Antennae with ten joints, not plumose; costal cell thickened, pl.36, fig.7.....25. Corynoneura (male)

gg Antennae with seven or eight joints

h Thorax with a longitudinal fissure; wings black with white markings, pl.31, fig.16, and pl.27, fig.16 28. Chasmatonotus

hh Thorax without this fissure

i Claws cleft, venation as figured; antennae seven-jointed in male and female, pl.34, fig.16 29. Telmatogeton

ii Claws simple

j Very small species; black, including its legs, wings and halteres; male with fourteen nearly bare joints, female with seven joints; legs with woolly hairs; metatarsi somewhat elongated; claws distinct, pl.34, figs. 6–11.....31. Hydrobaenus

jj Not such flies

k Antenna of male with eight joints; female like Orthocladius, (Australia), pl.36, fig.26 32. Doloplastus

kk Antenna of male not eight jointed; the female with seven joints

l Wings very short, in the female scarcely reaching the middle of the abdomen; the abdomen with a seta-like tubercle near the tip on each side; fore tibia longer than the metatarsus (Spitzbergen) .....33. Smittia

ll Wings of moderate length

m Thorax prolonged and bent downward; halteres hammer-like, pl.35, figs. 26, 27, 28 (Argentina). Synonym of Chironomus? 34. Burmeisteria

mm Thorax highly arched; halteres with knob (*Group Chironomus*)

n The fourth tarsal joint obcordate, shorter than the fifth. {37. Thalassomyia / 45. Scopelodromus}

nn Tarsal joint linear

o Wings bare

p Front metatarsi as long or longer than the tibiae.....38. Chironomus

pp Front metatarsi distinctly shorter than their tibiae

q Legs black and white annulate, at least the fore pair...39. Cricotopus

qq Legs not so banded

r Posterior branch of cubitus sinuous, pl.30, figs. 1 to 4 40. Camptocladius

rr This branch straight, gently arched, pl.30, figs. 5 to 10 41. Orthocladius

oo Wings hairy

p Front metatarsi longer than their tibiae 42. Tanytarsus

pp Front metatarsi shorter than their tibiae
q Thorax produced conically in front over the head; hind tibiae dilated and hairy, pl.34, fig.24
43. Eurycnemus
qq Thorax moderately produced; hind tibiae not dilated
44. Metriocnemus

cc Antennae with thirteen to fifteen joints
f Antennae fifteen-jointed; European and tropic genera
g Wing hyaline; legs very long; antennal joints of varying lengths, pl.35, figs. 1, 2, 3.....30. Macropeza
gg Wings spotted (West Indies and Mexico)....5. Oecacta
ff Antennae with fourteen or fewer joints
g Thorax rounded and not produced over the head; antennae with thirteen or fourteen joints; legs of moderate length
h Antennae with thirteen joints; wing venation as shown on pl.35, figs. 10 and 14
i Palpi with three joints. (This is probably a synonym of the next).....2. Tersesthes
ii Palpi with four joints.....1. Leptoconops
hh Antennae with fourteen joints, plumose in the male, sparsely haired in the female; wing venation as on pl.17, figs. 13 to 16.....(*Group Ceratopogon*)
i Wings hairy; last joint of tarsus with an empodium
j Empodium well developed; almost as long as the claws, these without setae, pl.18, fig.7
3. Ceratopogon
k Hind metatarsi shorter than the second tarsal joint, or both of equal length
(Sub. gen. Forcipomyia)[1]
kk Hind metatarsus longer than the second joint
(Sub. gen. Ceratopogon)
jj Empodium not so distinct, less than half as long as the claws; these furnished with setae on the under side, pl.18, fig.8.....4. Culicoides
ii Wings bare; pulvilli and empodium wanting
j Wing with R_1 distinctly separated from R_{2+3} and not connected with it by the crossvein-like R_2, pl.17, fig.15.....6. Bezzia
jj Wing with R_2 present; cells sometimes indistinct, pl.17, figs. 13, 14, 16
k Media wanting, pl.17, fig.13
7. Brachypogon

[1]According to Kieffer (1902) this subgenus can not stand, because in some species one sex would be classed here and the other sex with the next subgenus.

kk Media present.....(*Xylocrypta*[1])
l Femora unarmed.....8. Ceratolophus
ll Some of all the femora spinose beneath
9. Palpomyia
m Neither fore nor hind femora thickened[2]
n Having hairy soles (plantae)
1. Subgenus Alasion
nn Having spinose soles (plantae), pl.17, fig.16
2. Subgenus Sphaeromyas
mm Either fore or hind femora thickened
n Hind femora thickened, spinose beneath
3. Subgenus Serromyia
nn Fore femora thickened, pl.37, fig.9
4. Subgenus Heteromyia
gg Thorax produced over the head; legs usually quite long; antenna of the male usually with fourteen joints; that of the female with seven joints. (Go back to *ii* following *i*, 29 Telmatogeton, page 90, and read through to *qq*, Metriocnemus)

KEY TO GENERA OF THE NORTH AMERICAN CHIRONOMIDAE

a Wings rudimentary (Pacific coast), pl.35, figs. 15 to 24
11. Eretmoptera
aa Wings present
b The M–Cu crossvein present, pl.37, fig.24
c Antennae with fifteen joints; both in the male and the female the apical joint oval, pl.27. (Go back to the Group Tanypus, *f*, p. 89, of the preceding key.)
cc Antennae with fourteen or fewer joints, when the apical joint is oval then antenna with fewer than ten joints
d Antenna of the male with fourteen joints, the apical joint very long and cylindrical; antenna of the female with seven or eight joints; fourth tarsal joint obcordate; wings bare, pl.30, fig.13
35. Diamesa
dd Antenna of male with nine joints, short haired; antenna of female with eight joints. The female does not appear to differ from Diamesa .....36. Eutanypus
bb The M–Cu crossvein absent
c Wing club-shaped; the costal cell thickened, pl.36, fig.7; antenna of male with ten, the female with six joints..25. Corynoneura
cc Not as above
d Thorax with a longitudinal fissure; wings black with white markings; antennae seven-jointed in male and female, pl.27, fig.16, and pl.31, fig.16.....28. Chasmatonotus

[1]This division is called Genus Palpomyia by Kieffer (1902).
[2]This division is called Subgenus Palpomyia by Kieffer.

dd Thorax without a longitudinal fissure
e Claws cleft; antennae seven-jointed in male and female; halteres long (Alaska and Oregon).....29. Telmatogeton
ee Claws not cleft
f Antennae with thirteen to fifteen joints
g Antennae with fifteen joints; wings spotted (West Indies and Mexico).....5. Oecacta
gg Antennae with fourteen or fewer joints
h Thorax rounded, not produced over the head; antennae with thirteen or fourteen joints; legs of moderate length
i Antennae with thirteen joints; wing as figured, pl.35, fig.10. Palpi with three joints. (=Leptoconops Skuse?).....2. Tersesthes
ii Antennae with fourteen joints; wing venation as figured, pl.17, figs. 13 to 16. (Go back to the Group *Ceratopogon hh* on p.92 of the previous key.)
ff & hh Thorax produced over the head, legs usually long; antennae of male with the fourteenth joint long, slender, and plumose (female with seven joints). (Go back to group *Chironomus mm*, p.91 of previous key.)

The subdivision of the Group Ceratopogon into smaller genera and subgenera as given in the first key is adapted from one given by the Abbe J. J. Kieffer (1902), with some slight modifications. The three South American genera Psychophaena, Tetraphora, and Didymorphleps, have been omitted from the key. They are probably synonymous with previously described genera, though from the brief descriptions it is impossible to say. They all belong to the Group Ceratopogon, and their descriptions are all reproduced upon a subsequent page.

Genus 1. Leptoconops Skuse

Proc. Linn. Soc. N. S. W. 288. 1889. (Pl.35, fig.14)

Antennae in female 2+11 jointed; first joint of scapus large, disciform; second smaller, globose; flagellar joints globose, gradually diminishing in size, more ovate towards apex, terminal joint elongate-ovate. Proboscis prominent. Palpi four-jointed; first and second joints small, third greatly incrassated, about three times the length of the first or second; fourth not as long as last, slender cylindrical; wings naked. All longitudinal veins taking their origin at the base of the wing. Venation as figured. Australian species.

Genus 2. Tersesthes Townsend

Psyche. 1893. 370. (Pl.35, figs. 10, 12, 13)

Antennae 13-jointed, set in large, circular excavations in the middle of the head; first joint largest, round; second more elongate, smaller, but larger than the following joints; last joint elongate conical; intermediate ten joints equal, submoniliform, with hairs somewhat shorter than width of joints. Palpi three-jointed, longer than proboscis, first joint shortest, second joint swollen, third narrow with a terminal whorl of hairs; proboscis consisting of a lower lip (labium), with the lancets free but usually more or less approximated to its anterior aspect, both of equal length, extending straight downward, about as long as the head; lancets serrate on the outer edge at tip. No ocelli. Eyes reniform, rather deeply excavated on the inside margin, dichoptic, front averaging one third the width of the head. Thorax moderately stout, but not humped, a little wider than the head, longer than wide, without transverse suture, scutellum prominent. Abdomen seven-jointed, somewhat elongate, not wider than the thorax, first three segments subequal, fourth smaller, three terminal segments narrowed, ovipositor exserted, consisting of two clavate pieces joined laterally on the basal half, and terminally divergent. Wings moderately broad, not elongate; hind margin with a delicate fringe of hairs, the surface sparsely clothed with very short, microscopic hairs (revealed only with a high objective); six longitudinal veins, first and second approximated, strongest, ending at about one third the length of the wing; third gently curved distally and ending near the wing apex; fourth apparently forked, fifth distinctly forked, sixth becoming obsolete before fork of the fifth; an apparent rudiment of a seventh vein; no crossveins, except one at extreme base of wing, which connects the first and sixth veins, marginal vein not extending beyond the tip of the wing. Legs slender, not dilated, coxae not elongate; hind tibiae spurred, middle and even front tibiae with microscopic spurs; metatarsi elongate, second joint of hind tarsi also elongate, of middle tarsi somewhat elongate, of front tarsi scarcely so, penultimate tarsal joint of all the feet shortened, the last and ante-penultimate joints about equal; no pulvilli.

Professor Mik in the Wiener Ent. Zeitung, 1894, p.164, says: ".....Dieses Geader lässt sich ohne Mühe auf jenes der Gattung Corynoneura Winnertz ..... zuruckführen (Vergl. V. d. Wulp Dipt.—Neederl. 1877. Pl.VIII. fig.6), ohne dass ich hiermit etwa den Bestand der Gattung Tersesthes anzweifeln möchte ....." Upon comparison of this description with that of Leptoconops Skuse, and of pl.35, fig.10, with fig.14, it will be seen that these genera are certainly very closely related if not identical. The only marked difference is that Leptoconops has two small basal palpal joints while Tersesthes is said to have but one (i. e. Leptoconops has four-jointed and Tersesthes three-jointed palpi). Only one species.

Tersesthes torrens Townsend

1893. Tersesthes Town. Psyche. 371

Female. General color blackish; eyes dark brown; antennal excavations cinnamon color, nearly three times the diameter of first antennal joint; front, face and lancets shining black, the front with four blackish hairs on vertical margin arising from four papillae; antennae black, clothed with whitish pubescence; palpi blackish, labium brownish with some whitish pubescence terminally; occipital orbits with a few black hairs. Thorax and scutellum deep shining black, smooth, glabrous, except that the thorax has some scattered black hairs anteriorly. Abdomen soft opaque brown, varying to light brown, in some of the specimens flavous or rufous at base; balsam mounts showing two oval black spots (bodies?) at base of fifth segment; ovipositor brownish. Legs blackish, tarsi brownish, tibiae slightly so. Wings grayish hyaline, with hardly a smoky flavous tinge, the delicate fringe of hind margin somewhat longest on anal angle where it terminates abruptly; veins pale, except first and second longitudinal veins, which are brown and end in a brown stigma on costal margin (the first vein becomes obsolete just before reaching stigma); halteres brownish, knobs whitish.

Length of body (inc. ovipositor), one and three-fifths millimeters (empty) to two and one-fifth millimeters (abdomen distended with blood); of wing one and one-fifth millimeters. Fresh and alcoholic specimens are slightly longer. Described from both dried and alcoholic specimens and balsam mounts. Six specimens collected June 21, on Continental divide, Socorro county N. Mex., 7000 ft.

GROUP CERATOPOGON Meigen
Illiger's Mag. 11:261. 1803

This group may primarily be divided into two series; those species having hairy wings belonging to one and those with bare wings to the other. The larvae of the former group usually live under bark, while those of the latter are aquatic. The larvae of the first group may be characterized as follows: The head is short, the antennae minute, the mouth parts are small, and the mandibles apparently move in a more or less vertical plane. The mandibles in some species have several apical teeth (pl.17, fig.6). The body consists of 12 well-marked segments of which the first three, usually a little larger than the following, belong to the thorax. The head, thorax, and abdomen are provided with various spines, setae, and tubercles, differing with the species. On the ventral surface of the first thoracic segment is the anterior proleg, a short, more or less cylindrical process, divided into two branches, at the tip of each of which is a crown of a few claws (pl.17, fig.7). The last abdominal segment has a pair of prolegs, each with a few bilobed claws (pl.17, fig.8). Blood gills appear to be present and consist of delicate white filaments. The pupae of the members of this group remain partly sticking in the larval skin, the thorax and the first three or four abdominal segments projecting out (pl.17, fig.9). The thorax is large, prominent, the respiratory trumpets (fig.9, *t*) when present are small and inconspicuous; the abdominal segments variously armed with spines and setae.

The eggs and the method of egg laying of several members of the second group will subsequently be described. The larvae of the second (aquatic) group swim well with a writhing snake-like motion. They are usually whitish in color, slender, 12-jointed (not counting the head), the thoracic segments shortest; the middle abdominal segments of the greatest diameter, and the last segments usually longest (pl.17, fig.1). The head is very small, somewhat elongate, oval, with a pair of eyes, each eye consisting of one or two pigment spots. There are usually a few setae upon the head. The antennae (pl.18, figs.1a and 3a) are very small and inconspicuous, and in all species which I have seen, two-jointed. Of the mouth parts the

mandibles are the most conspicuous, slender at the tip and simple, but enlarged basally (pl.18, fig.4). The labrum is rounded and provided with one or two pairs of papillae, which may be larger than the antennae and of similar construction (pl.18, fig.1b). The maxillae (fig.2*mx*) are fleshy, lobed, and each provided with a large two-jointed palpus (p). The labium is quite small and inconspicuous, and differs from the corresponding part in Chironomus in having a soft and rounded edge, but upon its inner surface forming the floor of the mouth cavity it is heavily chitinized and formed into one or more cephalad projecting teeth (pl.18, fig.2*l*). The thorax and abdomen are wholly without prolegs; usually with but few or no setae excepting at the caudal end where there are about eight long setae and a few short ones. Projecting from the rectum, when not retracted, may be seen the delicate white blood gills.

The pupa is brownish, somewhat tapering, with an ovate thorax. It floats nearly motionless at the surface of the water, or is attached to plants a little above the surface but still within the water film. The respiratory trumpets are slender, and more or less cylindrical with the aperture slightly enlarged (pl.18, figs.9 and 10*t*). The abdominal segments are provided with spines, setae and tubercles. The anal fin ends in two pointed lobes (pl.18, fig.11). Professor Mik, on page 183 in Vol. 7 of the Wiener Ent. Zeit., described a species of Ceratopogon with hairy wings, but having a footless larva. This form occupies a place between the above two groups; and its habitat, the very moist or wet, ulcerous parts of the stems of Aesculus hippocastanum, also suggests an intermediate form. This species differs from all known members of both groups in possessing instead of either setae or prolegs a retractile disk, on the periphery of which are arranged five pairs of curved spines. It agrees with the second group in having no prolegs, and with the first in having a mandible with a three-toothed margin.

The pupa has cylindrical, elongate respiratory trumpets; the abdomen is provided with spiny tubercles, and the caudal end has a crown of tubercles. The adult would be classified with Kieffer's genus Culicoides.

Another aberrant form, C. murinus Winn. is noted by G. Gercke on p.164, Wiener Ent. Zeit. Vol. 5. The larva was not observed, but the pupa, although of an aquatic form, gave rise to a hairy winged adult. The respiratory trumpets of this species are quite peculiar. They are elongate, cylindrical, and then suddenly contracted on the apical third. An Ithaca, N. Y., specimen, bred from the slender snake-like aquatic larva, also gave rise to a hairy winged adult. The larval skin was unfortunately lost. The pupa has a cylindrical breathing trumpet resembling the one described by Gercke.

The imago. The imagines of the group Ceratopogon are very small flies, commonly called "punkies," which differ from the other genera of this family in having more robust legs, in their wing venation, and in their not having the thorax projecting over the head. To this group belong the genera Ceratopogon sens. str., Culicoides, Bezzia, Brachypogon, Ceratolophus, Palpomyia (with its subgenera Alasion, Sphaeromias, Serromyia and Heteromyia), and probably Oecacta, Psychophaena, Tetraphora and Didymorphleps.

Head flattened in front; epistome slightly projecting; palpi four-jointed, the second joint longer or thicker than the others, the fourth almost as long as the second; proboscis somewhat projecting; formed for biting; antennae elongated, filiform, 14-jointed, the first joint annular, the following eight spherical or somewhat annular; in the male long plumose, in the female with few hairs, the last five joints in both sexes elongated, especially in the male, and furnished with short hairs; eyes reniform, the ocelli wanting. Dorsum of the thorax very convex, scutellum narrow, metanotum short. Abdomen eight-segmented, rather long, sometimes narrowed basally. Genitalia somewhat prominent. Legs moderately long and quite robust; especially the femora, which are often furnished with spines or setae; tibiae sometimes flattened; tarsi various, the claws with or without teeth or setae. Wings bare or hairy, folded over the back when at rest; the media simple, the cubitus always two-branched; wing venation of the types shown on plate 17, figs. 13 to 16; halteres distinct and uncovered.

Genus 3. Ceratopogon sens. str. (Kieffer)

Bul. Soc. Ent. Fr. 69. 1899. Ceratopogon Meigen pt. (1803).

(Pl.18, fig.7)

Wings long-haired, especially those of the female. Last joint of the tarsus with very apparent and hairy (not setose) empodium.

Other characters as in the group Ceratopogon. Type species C. bipunctatus Linn. There are numerous American species belonging to this genus.

Ceratopogon sp.

(Pl.17, figs. 4 to 8)

The larvae of this species were found under oak bark. They are five or six mm. long, bristly, cylindrical, tapering slightly from the thorax to the caudal end; color whitish. Head dark brown, eye spots and mouth parts blackish; each of the thoracic feet armed with a circlet of about eight simple, blackish claws (fig.7), anal feet each with nine or ten bilobed blackish claws (fig.8). The mandible is as shown in fig. 6. The chaetotaxy of the head and body is shown in figs. 4 and 5. Each segment of the abdomen has upon each side a long, honey yellow curved bristle with slightly enlarged end, two slightly curved black, barbellate bristles, two slightly curved long black setae, and upon the dorsum a pair of honey yellow spear-shaped setae. The thoracic segments are similarly armed, except that the first has two slender yellow setae instead of the spear-shaped pair.

The pupa is 2.5 to 3 mm. in length, yellowish, head darker (fig. 9). The thorax with a triangular shield-like dorsum, with a pair of yellow barbellate blunt filaments anteriorly, laterally and posteriorly; and a short pair in front of the reddish imaginal eyes. The respiratory trumpets (fig.9*t*) are small, rather inconspicuous, with the apical end enlarged. The mesothorax has two barbellate filaments; the first four abdominal segments each with eight yellow, pointed, delicately barbellate filaments and two shorter blunt ones. The remaining segments, which are concealed in the cast larval skin, are unarmed; the apical end is provided with a pair of slender, pointed lobes.

Only one specimen of the imago was reared and is not sufficiently well preserved to describe. For further descriptions of larvae and pupae of members of this genus the reader is referred to Mr W. H. Long's paper (1902).

Subgenus Forcipomyia Megerle in litt

Meigen Syst. Beschr. 1:59. 1818

Labidomyia Stephens Catl. Brit. Ins. 1829.

The manuscript name Forcipomyia bipunctata Linn. was given to the species now known as trichopterus Meig., by Megerle and later Stephens grouped the species bipunctata, trichopterus, pictipennis Meig.,

nemorosus Meig., nemoralis Meig., and others under the name of Labidomyia without giving a description of the genus. The type species trichopterus has the characters of Ceratopogon sens. str., but has its metatarsus shorter, or no longer than the following joint, and the venation of the type shown on the pl.17, fig.14. The Abbe J. J. Kieffer, however, says this subgenus cannot stand because that in certain species the male would be classed as Forcipomyia and the female as Ceratopogon.

Genus 4. Culicoides Latreille

Gen. Ins. et Crust. 4:251. 1809. (Pl.18, fig.8)

Antennae filiform, 14-jointed, hairy; the second and the six following, cylindrical ovate; the four or five following these rather more elongate, subcylindrical, the last one largest, ovate cylindrical. The proboscis markedly longer than the head, conical. The wings deflected, the venation resembles that figured on pl. 17, fig. 14. The type is C. pulicaris L. (Ceratopogon punctata Meigen). Kieffer (1902) characterizes the genus as follows: The surface of the wing with long hairs, at least that of the female; the tarsi with minute pulvilli not half as long as the tarsal claws, the latter with long setae at the bases. A number of North American species belong to this genus.

Genus 5. Oecacta Poey

Memorias Hist. Nat. Cuba. 1:236. 1851

Judging from the description and figures given by Poey this genus is very closely related to either Ceratopogon or Culicoides. The only important distinction given in the description is the statement that there are fifteen antennal joints instead of fourteen. From the figure given it appears that the author had counted the basal articulation beneath the large basal joint as one, which would only make fourteen joints as reckoned for Ceratopogon. The wing venation, assuming Poey's drawing to be strictly correct, does not differ so markedly from a typical Ceratopogon as to exclude it from that genus. The venation resembles that shown on plate 17, figure 14, excepting that R_3 does not quite reach the margin, and R_2 seems to be wanting. R_1 terminates in the stigma. Since Professor Townsend (1897), who has seen this fly, did not question the validity of the

genus. I shall for the present regard it as distinct. The following is an abstract of Poey's description:

Antennal joints, fifteen; palpal joints, five; ocelli, tibial spurs, and pulvilli wanting; wings hairy; cells few in number; sexes similar. The antennae of the male appear to be a little more hairy than those of the female.

Oecacta furens Poey

Memorias, etc. 1:236. Tab. XXVII. 1851

Length 2 mm. from the head to the end of the wing; thorax bronze colored, spotted with fuscous; abdomen fuscous; legs whitish, the articulations and a ring upon each femur and tibia, fuscous; front and antennae rufous; wings whitish, spotted with fuscous; halteres yellow. The wings are broad, covered with minute scales and with a conspicuous fringe on the margin.

Townsend (1897) says: "Dry pinned specimens show the wings to be strongly iridescent in certain lights, the dark and white spots alike, as well as the veins and whole wing surface, especially noticeable being various rich shades of blue and violet. Poey remarks at some length on this peculiarity. When the wing is held up to the light and looked through the dark spots appear faint, excepting only the elongate rectangular black stigma; this can be seen with the naked eye."

Cuba (Poey); Mexico and Jamaica (Townsend).

Genus 6. Bezzia Kieffer

Bul. Soc. Ent. Fr. 69. 1899

Belongs to the group Ceratopogon. Wings bare, tarsi without empodium, radius 3-branched (i. e. without the cross-vein-like R_2). (Pl.17, fig.15). Type C. ornata Meigen. Several American species belong to this genus.

Bezzia setulosa Loew

1861 Ceratopogon Loew, Berl. Ent. Zeit. 312

(Pl.18, figs. 4, 5, 6, 9, 10, 11)

The larvae were found in the Renwick swamps, Ithaca, N. Y., July 10th. They are white without brown markings and about 7 mm. long. The head is brown, each eye consists of two nearly contiguous spots. On the dorsal surface of the head are several pair of small setae. The labrum is rounded, with two pairs of small apical papillae, one pair apparently jointed, and one or two

pairs with setae. Mandibles curved, slender at the apex, stout basally (fig.4). The hypopharynx lies rather far back from the mouth opening, about on a line with the eye spots. It is curved, like the jawbone of a mammal, the dorsal surface of the middle section being fringed. In fig. 5 this fringe is flattened down. The labium is rounded, and has a single cephalad projecting tooth on its inner surface. Upon the outer surface are two setae on each side (fig.6). The body is wholly devoid of setae excepting at the caudal end. At the caudal end there are eight long setae arranged in four groups of two each (pl.17, fig.3). Besides these there are four very small and delicate ones. The blood gills (retracted in most specimens) are white, short, slender, and lanceolate in outline.

The pupa is dark brown in color, with the abdomen slightly paler. Length 3.5 to 4 mm. The respiratory trumpet is slightly enlarged at the apical end (pl.18, fig.9), about five times as long as wide. Upon the dorsal surface is a group of about ten small setae. Upon the dorsal surface of the first abdominal segment there is a group of five or six very small setae on each side. The following segments, excepting the last two, have from 6 to 10 setae on the dorsal surface, arranged as shown in fig. 10. Upon the ventral surface each segment has from 8 to 10 very small setae, each placed on the apex of a prominent tubercle (fig.11). The anal fin consists of two pointed lobes with blackened tips.

To Loew's description of the imago (loc. cit.) may be added that the fore and middle tibiae sometimes have one or two stout black setae besides the fine hair-like setae; and in the female each claw has a very small tooth on the inner side. The male genitalia as shown on pl. 32, fig. 1.

Bezzia sp.

(Pl.17, figs. 10 to 12)

The larvae were taken from the stomach of a brook trout at Saranac Inn, N. Y. They do not appear to differ much from the larvae of B. setulosa, excepting that the labium possesses three teeth on the inner surface instead of one (fig.10). The pupa (fig.11) may possibly belong to this species, for it is the only species which was found in that vicinity at that time, but of it many specimens were found. The respiratory trumpet is as shown in fig. 12. Each abdominal segment has upon its ventral surface several elongate brown spots. The setae are short, and the basal tubercles smaller and fewer than in B. setulosa. The lobes of the anal fin are elongate and pointed (fig.11).

Adults bred from the pupae described above were preserved in alcohol, and hence the color characters are somewhat doubtful.

Female. Brownish, abdomen pale, legs brown and white, claws simple, no pulvilli nor empodium; fourth tarsal joint one-half as long as the fifth, posterior tarsi ciliate with hair-like setae, last joint with only a few hairs; wings bare, without the crossvein-like R_2; length 3.5 mm. Head and mouth parts brownish; antennae brown with white incisures; basal joint brown. Thorax brown (perhaps cinereous in dried specimens) with indications of dorsal stripes. Abdomen brown dorsally and white ventrally. Coxae brown, fore and middle legs white, with brown knees and articulations, hind legs brown, basal $\frac{2}{3}$ of the femora, basal $\frac{1}{5}$ of the tibiae, and of metatarsi whitish. In some specimens the fore and middle femora and tibiae have a brown ring near or beyond the middle, and the posterior femora are wholly brown. Sometimes the posterior tibiae also have a whitish ring near the tip and the hind tarsi whitish. Halteres white with the tip of the knob sometimes darkened.

Genus 7. Brachypogon Kieffer

Bul. Soc. Ent. Fr. 69. 1899

Belongs to the group Ceratopogon distinguished by having the wings bare, in having media coalesced with R_{4+5}, the branches of the radius coalescent, pulvilli absent. (Pl.17, fig.13). Type Ceratopogon vitiosus Winn. No North American species have thus far been described.

XYLOCRYPTA Kieffer

Genus Xylocrypta Kieffer. Bul. Soc. Ent. Fr. 69. 1899

From the other genera of the group Ceratopogon it is distinguished in having the wings bare, the media simple, and the tarsal claws with teeth. Type species Ceratopogon fasciata Meigen.

Xylocrypta Kieffer is made a synonym of Palpomyia Kieffer by its author (1902). The name may be retained for a group, including species, having a wing of the type shown on pl.17, fig.16, and having femora either with spines (genus Palpomyia) or without (genus Ceratolophus).

Genus 8. Ceratolophus Kieffer

Belongs to the group Ceratopogon. Wings bare; media simple, R_1 and R_3 connected by the crossvein-like R_2 (resembling Palpomyia pl.17, fig.16); femora unarmed.

This name was first given by its author (Kieffer 1899*b*) to a genus characterized thus: The wings are bare, the media simple, the tarsal claws without teeth. Type of the genus is Ceratopogon femoratus Fabr. This species has now been made the type of the subgenus Serromyia (q. v.). In a later paper Kieffer (1902) made Ceratolophus a subgenus of Palpomyia. But since, according to Skuse (1889), Palpomyia has the femora armed, Ceratolophus better be retained as a distinct genus. Several American species.

Ceratolophus sp.

The egg-laying of this species was observed by Professor Needham, Dr. A. D. MacGillivray and the writer in July. The little flies hover in considerable numbers near the rocks over which the spray of Fall creek dashes. Selecting a suitable spot upon the rock, above the surface of the water, but splashed by the spray, the female begins egg-laying. The eggs are laid rapidly, about two per second, until several hundred eggs have been set up on end, side by side in a little clump of about 5 mm. in diameter. Upon a single suitable rock many clumps may be found. The eggs when first deposited are white, but they soon become black. Another species not determined lays a similar clump of eggs on the surface of the pond lily leaves. The larvae which emerge I was unable to distinguish from newly hatched larvae of other species.

Imago. Black, legs paler, length 2 mm. Head subshining black; mouth parts and antennae fuscous, the basal joint of the latter black. Thorax wholly shining black, when viewed obliquely a little pruinose. Abdomen dull black, the first and last joints brownish. Femora yellow, the hind pair brown on the apical half; the fore tibiae yellow, the middle pair pale brown, the hind ones dark brown. All tarsi brown. All legs with few hairs and no prominent setae. Wings hyaline, bare. Halteres black. The crossvein-like R_2 is situated near base of the radial cell. Ithaca, N. Y.

Genus 9. Palpomyia Megerle in litt.

Meigen, Syst. Beschr. 1:65. 1818. Stephens, Catalogue Brit. Dipt. 238. 1829

On page 238 of his Catalogue of British Insects (1829) Stephens affixes this name to all species of Meigen's group B of Cera-

topogon. The name was first published by Meigen as a manuscript name of Megerle's, for a species belonging to the above-mentioned group, a group characterized as having the flexor surface of the fore femora spinose.

Accordingly, and as Skuse (1889) has already stated, Palpomyia may be defined thus: Belongs to the group Ceratopogon; wings bare, with five radial cells, R_2 present; media simple; some or all the femora spinose beneath; pulvilli and empodium wanting.

Kieffer (1902) in his definition for the genus includes also those species whose femora are without setae; but it seems to me that Skuse's interpretation of the genus has the claim of priority, thus leaving Ceratolophus as a distinct genus and using the name Palpomyia for those species having setose femora.

Subgenus 1. Alasion rondani

Dipt. Prodromus. 2:14. 1857. (=Apogon, Prodromus. 1:175. 1856. Preoc.)

In the analytical table Apogon is briefly described as follows: Femora, at least the anterior pair, spinose beneath; antennae of the male verticillate with short hairs as in the female. Spec. typ.; Ceratopogon hortulanus Meigen. On page 14, Prodr. II. '57, Rondani changes the name Apogon to Alasion on account of preoccupation.

C. hortulanus is made a synonym of C. flavipes by later authors. These authors say nothing of the short-haired antennae of the male, and it appears that there is perhaps some error here on Rondani's part. The type species C. flavipes is placed among the Serromyia by Bezzi. This seems unwarranted since the hind femora are not thickened. In the table given by Kieffer (1902) it would fall in the division with Palpomyia.

The name might stand as a subgeneric name as one of the divisions of Palpomyia. It may then be defined as follows: Wings bare, R_2 present, crossvein-like; media simple; some or all the femora spinose beneath, not thickened; the soles (plantae) of the feet hairy, not spinose; in this last character distinguished from Sphaeromyas. Several American species.

Subgenus 2. Sphaeromyas Stephens

Catalogue Brit. Dipt. 236. 1829; Curtis Brit. Ins. 6:285. (Pl.17, fig.16; pl.18, figs. 13, 14)

In the figure given by Curtis the tarsal claws resemble Winnertz's (1852) pl.I, fig.15a, and the wing pl.VIII, fig.63.

Wing bare, five radial cells, R_2 present, crossvein-like; media simple; some or all the femora spinose beneath; terminal joint of the tarsi armed with a double row of spiny bristles, each claw (at least in the female) with a tooth on the inner side. Belongs to group Ceratopogon. Type of the genus C. fasciatus Meigen (=albomarginatus Steph). Several American species.

Sphaeromyas argentatus Loew

1861 Ceratopogon Loew. Berl. Ent. Zeit. 310

The egg-laying of this species was first observed by Professor Needham, by whom my attention was called to it. During the latter days of June and the first of July about sundown the female fly hovers about three or four inches above the water's surface close to the shore in a place sheltered by the shrubs and weeds. With the head pointing toward the shore and the body swaying rhythmically laterally to and fro, the egg-laying begins. The eggs are enclosed in a gelatinous ribbon, placed at right angles to the long axis. A short section of this ribbon with the eggs side by side is shown on pl.31, fig.9. The ribbon when deposited is about 1.5 inches in length, flat, and appears wrinkled like a paraffin ribbon. The lateral swaying of the body at the beginning of the egg-laying is of about one inch amplitude, but as the ribbon of eggs increases, the amplitude decreases until just before deposition it is less than $\frac{1}{2}$ inch. When the egg string is about $\frac{1}{4}$ inch long the fly seizes it with her hind and middle legs, the hind legs guiding, the middle legs paying out the string as its length increases. The fore legs are folded up under the body. This egg-laying process occupies from three to five minutes; when completed the fly suddenly darts down to the water's surface, deposits her eggs and flies away.

The eggs when first laid are whitish, but later, as development progresses, they become brown. Each egg is about 0.4 mm. in length by .07 in width; somewhat pointed at one end and

flattened at the other, the latter with a minute rectangular bolster with knobbed corners.

The larvae emerge in the course of four or five days; a slender, white, snake-like creature, differing in no wise from the full grown Ceratopogon larva excepting that it has a relatively larger head; the posterior end has the usual setae. None were reared to maturity, hence no dissections could be made of the head, nor were any pupae obtained. The imago has been fully described by Loew (1861).

Subgenus 3. Serromyia Megerle in litt.

Meigen Syst. Beschr. 1:66. 1818; Prionomyia Stephens. Cat'l Brit. Ins. 237. 1829; Ceratopogon pt. C. Meigen, Stephens, loc. cit.

The name Serromyia was first published by Meigen as a manuscript name of Megerle's for Ceratopogon femoratus Fabr. Later, in 1829, Stephens places into the Prionomyia all of Meigen's Ceratopogon group C, the members of which have the hind femora thickened, and spinose beneath. According to both Skuse (1889) and Kieffer (1902), the genus may be defined as follows: Wings bare, the crossvein-like R_2 present; hind femora thickened, and spinose beneath. Belongs to the group Ceratopogon. Several North American species.

Subgenus 4. Heteromyia Say

Amer. Ent. 2:79. 1825; and Compl. Wr. 1. (=Pachyleptus Walker. Ins. Saunders Dipt. 426. 1856.)

Heteromyia may be considered as a subgenus of Palpomyia and defined thus: Wings bare, the vein R_2 present, crossvein-like (resembling pl.17, fig.16); media simple; femora spinose beneath, fore femora thickened (pl.37, figs. 8 and 9). Say's description is as follows:

Artificial character. Antennae porrect, filiform, 14-jointed, five terminal joints elongated; palpi exserted, four-jointed; basal joint shortest, a little contracted in the middle; ocelli none; eyes reniform; posterior feet much elongated, slender, and with a single nail at the tip; anterior pair with somewhat elongated coxae, and much dilated femora, armed with a series of short spines on the anterior edge, on which the arcuated tibia closes.

Natural character. Body moderately slender; head small, rounded, flattened before; antennae in the middle of the face; first

joint large, but not long; the eight following joints suboval; the five terminal joints long, not dilated, cylindric, each being twice the length of the preceding ones; eyes reniform, large, wider beneath, and approaching above; stemmata none; palpi arcuated, four-jointed, first joint shortest, last joint longest; proboscis shorter than the head; thorax subglobular, convex above and projecting a little forward acutely before; beneath convex; scutel transverse; wings moderate, somewhat lanceolate; poisers naked; feet unequal; anterior pair with the coxae somewhat elongated; thighs dilated, and with a series of spines on the lower side; tibiae arcuated, accurately closing on the inferior surface of the thigh; tarsi moderate; intermediate pair slender, longer than the anteriors; third pair longest, slender, the tarsi elongated, terminated by a single long and slender nail.

In specimens of Heteromyia fasciata Say, I find the wing has the crossvein-like R_2 though very delicate and indistinct.

Walker's description of Pachyleptus agrees exactly with that of Say. Arribalzaga (1893) redescribes the genus at length for a specimen in his possession. Heteromyia fasciata Say, differs from Arribalzaga's description of Pachyleptus in the following particulars: Face convex and not keeled; the apical joint of the palpus is longer than the second and third, which are subequal; and the hind tarsi which are much elongated have only the first and second joints subequal, the others being shorter. As these differentiating characters are of specific rather than generic importance, I think Pachyleptus should be considered a synonym of Heteromyia.

In one particular only may there be a chance that the two genera are distinct. In Walker's description nothing is said of the wing venation excepting the statement that the veins are like those of Ceratopogon in structure; but Arribalzaga states that R_2 is wanting. This condition agrees with the figure given by Say (pl.37, fig.8). In the type species, however (H. fasciata), this vein is present, at least in all the specimens that I have seen, although it is quite delicate and indistinct. Should it be found that certain species do have this vein and others do not, the former may be called Heteromyia and the latter Pachyleptus Arribalzaga (=Pachyleptus Walker?)

There are several North American species.

Walker's (1856) description is as follows:

Pachyleptus. Nearly allied to Ceratopogon. Body slender; head small, nearly round; palpi moderately long; antennae mutilated; thorax convex; abdomen nearly cylindrical, somewhat contracted towards the base, much more slender than the thorax, and almost twice its length: posterior legs rather long and slender; femora subclavate; fore legs raptorious; femora thick, tibiae slightly curved, closely applied to the femora; wings narrow; veins like those of Ceratopogon in structure.

Ceratopogon sp. sens. lat.

(Pl.18, figs. 1–3)

The larvae were found in Eddy pond, Ithaca N. Y., in April. They are white with brown markings; length 8-9 mm. Head brown; each eye consists of two nearly contagious spots; antennae two-jointed and very short; setae on the head as shown in figure 3. The labrum (fig.1) is rounded, with a pair of jointed and a pair of simple papillae. The mandible is shown in fig.3*m*, the maxilla in fig.2*mx*, the latter has a prominent two-jointed palpus, labium (fig.2*l*) rounded, with three cephalad projecting teeth on the floor of the mouth cavity. The segments of the thorax are marked with brown, the first with three blotches on dorsal surface, the second with two lateral spots, and two longitudinal lines which rise at the anterior margin and extend half the length of the segment, the third with two nearly contiguous spots on each side, and a pair of spots on its anterior margin. Each abdominal segment has a pair of elongate spots at the anterior margin, a dorso-lateral and a ventro-lateral stripe, the latter prolonged anteriorly and joined by a transverse fascia at the incisure; a fine median central stripe is produced forward from the transverse fascia. These stripes vary in length, in some specimens forming almost continuous longitudinal stripes along the abdomen. Setae of caudal end are about eight in number, comparatively small, and arranged not in pairs but singly. Pupa and imago not obtained. Of this species specimens have been kept living in aquaria from October to April.

Ceratopogon sp. sens. lat.

Professor A. S. Packard (1870) published an account of a larva and pupa which belongs to the group of the bare-winged Ceratopogon. It is described as Tanypus sp. to which genus it certainly does not belong. The larva and pupa were found at Clear Lake, Lake county, California. The description states that the caudal end is without bristles or hairs of any

kind. It is said that the pupa has no respiratory appendages, the only peculiarity which would distinguish it from other known species belonging to this group.

Genus Psychophaena Phillipi

Verh. z. b. Ges. Wien. 628. 1865

Proboscis equalling the head in length; palpi four-jointed, third joint thickened, obconate, the fourth a little shorter, slender and cylindrical; antennae pilose, 14-jointed (also of the male?) the first joint thickened, the following seven subglobose and (in the female at least) not petiolate, the rest elongate, the apical one lanceolate; the posterior margin of the wing with long cilia; legs pilose, not spurred, the metatarsus longer than the following joints. The wing venation resembles fig.14, pl.17, but the media separates from R_{4+5} a little distad of the forking of the cubitus,' this forking being almost as far distad as the tip of the radial veins. The radial cells short. Type P. pictipennis Phillipi (Chile). This genus as defined does not differ from Ceratopogon or Culicoides.

Genus Tetraphora Phillipi

Verh. z. b. Ges. Wien. 630. 1865. (Pl.37, fig.18)

The antennae equal in length, the head and the thorax taken together, about 12-14 joints, moniliform, verticillate with long hairs, the basal joints subglobose, the intermediate ones narrowed apically, bulbous. Wings hairy, venation as in fig.18. Legs long, the first tarsal joint about as long as the four following. Type T. fusca. Phil. (Chile). From the figure of the wing it appears that this genus is probably a synonym of either Ceratopogon or Culicoides.

Genus Didymorphleps Weyenbergh

Stettiner Ent. Zeit. 44:108. 1883. (Pl.35, fig.25, after Weyenbergh)

The wing venation and other characters as figured and described by Weyenbergh is essentially that of a Ceratopogon or Culicoides, but according to this author is said to present some differentiating characters. The cilia of the anterior wing margin are coarse and bristle-like and of equal length; those of the posterior margin are more delicate and of

unequal length. The entire wing is so thickly covered with microscopic hairs that it appears nearly opaque. There are several peculiarities in the venation to which the author calls attention. The R_{4+5} does not reach the margin; parallel to and above it is a vein (perhaps a fold) which enters the margin; the latter vein is not connected with any vein at its base. Above this is a forked vein (fold) which has no connection at its base. This is absent in the female. This forked vein or fold is of common occurrence in many Ceratopogon wings. Upon each side of the cubitus there is a vein (probably a fold) running parallel to it. These folds are absent in the female. The halteres have prominent knobs. According to the text (but not the figure) the vein which enters the anterior wing margin before the mid-length of the wing has a point of contact with the bend of the one which enters the anterior margin a little distad of the middle. The legs and antennae are like those of Ceratopogon. In regard to the male antennae the author says: "Das 2te Glied diese Fühler hat der langen Haarbusch welcher Ceratopogon kennzeichnet, aber an der Spitze ist es so zu sagen gaffelig frisert und seine Innenseite nicht so glatt wie die Aussenseite, weil erstere kleine borstige Haare zeigt welche ein wenig vorragen."

Each joint of the antennae of the female possesses four long hairs, each hair about as long as the antenna.

Type of the genus D. hortorum Weyenbergh, l. c.

It does not appear that the venation differs materially from some species of Ceratopogon. Compare the wing of C. rostratus Winn., pl.IV, fig.23, Winnertz (1852). The other characters given certainly do not distinguish it, and therefore this genus must be considered as a synonym of either Ceratopogon or Culicoides.

Genus 10. Belgica Jacobs

Ann. de Soc. Belgique. 106. 1900

The head somewhat rounded, longer than high, a little wider than the thorax. Face flat, the eyes not emarginate, placed at half the hight of the face, "eyes not smooth." Antennae inserted opposite the eyes, a little lower than their transverse

diameter, with five distinct and separated joints; the first joint short, cylindrical, cut obliquely from without to within, the last joint as long as the third and fourth together, with truncated base and rounded tip. The antennal joints are provided with hairs, the last with longer and stouter ones. The fifth joint in certain specimens appears to have a suggestion of a division simulating a sixth joint. The epistome is prolonged, triangular, and truncate. The palpi not more slender than the antennae, have four joints, the last joint being one-half as long as the one preceding. The thorax is produced over the head, the humeri are prominent, the center of the thorax is arched, and widens out to the abdomen. The scutellum is triangular with truncated apex. Legs.—Anterior coxae are prominent, first pair is somewhat separated from the following pair, the femora are compressed and widened; the tarsal claws with a little subapical tooth and two pulvilli. The wings are stumpy, in the form of a flattened racket, more or less developed according to the specimen. Halteres are wanting. The abdomen is 8-segmented; in the male it terminates ventrally with a large plate carrying two lamellae covering the genitalia; with the female these organs are hidden in the abdomen. Translation from the original. The genus was erected for two Patagonian species, B. antarctica and B. magellanica.

Genus 11. Eretmoptera Kellogg

Biol. Bul. 1:82. (Pl.35, figs. 15 to 24)

Under this name Professor Kellogg published a description of a maritime fly which bears such a resemblance to the genus Psamathiomyia Deby that I at first considered them synonymous. There appear to be, however, several characters which may be of sufficient importance to separate them generically. In Eretmoptera the maxillary palpi are four-segmented, while in Psamathiomyia they are two-jointed; the female of the former has four-jointed antennae, while both sexes of the latter have six-jointed antennae. The remaining distinctive characters seem to be of specific rather than of generic value. The flies were collected December 27, 1898, by Mr J. C. Brown at Point Lobos, a rocky point on the Pacific

coast near Monterey, California. The flies, of which there were many, were resting or running on the surface of the ocean water of the tide pools, and had a tendency to gather in large numbers in "patches" and "in ball like masses" on the surface of the water. None were seen below the surface, nor were any seen flying. They moved about on the surface of the water very rapidly. The following is a description given by Professor Kellogg, of the species:

Eretmoptera browni Kellogg

Biol. Bul. 82. 1900

Male (fig.21). Length 2 mm. Head slightly broader than the thorax, eyes widely separated, very small, very convex, hairy, and with rather large facets; ocelli absent; antennae (fig.22) short, length 3 mm.; six-segmented, the basal segments wide and globose, the sixth segment longest, the second next, the third and fifth about equal, the fourth shortest, with a few short strong hairs on each segment; and the surface everywhere with a fine stiff pubescence. The mouth parts are of simple Nematocerous type, short, and with distinct labrum-epipharynx, maxillae, hypopharynx, and labium; mandibles absent; labrum-epipharynx (fig.19) short, broadly triangular, with obtusely rounded tip. Maxillae with short, weak, tapering, pointed lobe, and 4-segmented palpi, 3 mm. long; the palpi with the last two segments longest and equal, and all the segments provided like the antennae with a few short stray hairs and a fine stiff pubescence (fig.16); hypopharynx (fig.18) elongate, triangular, as long as the labrum-epipharynx, but narrower and more acute; labium (fig.17) short, lip-like, with free paraglossae, without pseudotracheae. The face is whitish with a median longitudinal dark line, and the antennary fossae with dark margins; the basal segment of the antenna is rather dark, the other segments pale. Thorax without bristles, dark above, pale beneath. Legs long and slender, whitish with blackish joints; middle and hind legs longest and equal, front legs only a little shorter; average measurement of middle leg, femur 1 mm., tibia 1 mm., tarsus 1 mm.; tarsus 5-segmented, segment one as long as segment two, three and four together; segment five slightly longer that segment four; tibiae of all legs with a single apical spur; tarsal claws strongly curved, thickened at base, with three delicate spines on basal half; no pulvilli; empodium (fig.15 emp.) rather long, curving, filiform, and plumose or pectinate for its whole length. Wings narrow, strap-like, extending only to fourth abdominal segment, length .75 mm., and wholly without veins; whitish, somewhat wrinkled,

and finely spinulose (fig.21). These strange veinless wings are not especially thin or delicate, but on the contrary are rather thickened, the costal margin being especially thickened and perhaps folded. The halteres (fig.20) or the structures which occupy the usual position of the halteres, are not of the usual pedicel and knobbed type common among Diptera, but are minute lobe or scale-like processes, appearing like rudiments of metathoracic wings; like the mesothoracic wings, they are rather thickened and finely spinulose; they are widest at the base and taper to a rounded tip; they average .08 mm. in length. Abdomen with nine segments, tapering gradually posteriorly; mottled blackish and gray above, lighter below, palest laterally; a few scattered, small, wholly inconspicuous hairs, the body appearing glabrous; external genitalia consisting of a pair of large, conspicuous, strong, articulated claspers (fig.24) which are covered with a pubescence.

Female. Length 2.5 mm., thus being ¼ longer than the male; this extra length is all in the abdomen, which is markedly larger than the abdomen of the male in every way. The head and thorax are narrower than the robust abdomen, which is subcylindrical, tapering only slightly posteriorly. Eyes as in the male very small, very widely separated, and hairy. Antennae only 4-segmented. Mouth parts essentially as in the male, with, however, appreciable differences in shape; the labrum-epipharynx is narrower at base, and is more pointed apically; the labium with paraglossae separated farther back and slightly narrower. The reduced wings and halteres like those of the male, the wings' length .85 mm., slightly elongated. The abdomen consists of nine segments mottled blackish, with conspicuous white sutural spaces, caused by the distension of the abdomen. The external genitalia are inconspicuous. There is a short, emarginate dorsal plate with rounded tips and a pair of lateral processes. There appears to be no extrusible ovipositor.

Pupa of female. A single pupa taken with the imagines from a tide pool. Length 2.5 mm. Immediately recognizable as pupa of the female from the similarity in size, shape and markings. Abdomen just as in the adult in regard to size, shape, color and markings. The antennae, legs and wings are folded on the lateral and ventral aspects of the anterior part of the body, and extending backwards to (hardly reaching) the posterior margin of the second abdominal segment. There are no external tracheal gills or elongated spiracles (breathing tubes). There are no bristles nor special clinging organs. The pupa is of a very simple, unmodified, unprotected type.

Genus 12. Halirytus Eaton

Ent. Mo. Mag. 12:60. 1875. (Pl.37, figs. 5, 6, 7)

Imago, female. Head suborbicular, palpi very short, two-jointed; antennae divergent, six-jointed, the basal joint very large, nearly orbicular, the next four much smaller, submoniliform, the apical joint oval, about as long as the preceding two together; the basal joint has one rather short and a few still shorter bristles near its middle, and the apical joint has a short bristle on one side, and a finer hair on the other side near its base, and some extremely minute pubescence, which is hardly discernible even under the microscope (fig.7); genae each with one minute bristle below the eye; epistome scutiform; eyes suborbicular, protuberant, close to their upper orbit behind are three short bristles, the hinder two are near together; ocelli absent. Mesonotum somewhat cucullate, being strongly arched in front and projecting forwards above the head; scutellum semi-elliptical, prominent, with a transverse line of minute erect bristles; metanotum very transverse, exceedingly short; the spiracles on each side of the mesothorax are very prominent; wings rudimentary, somewhat narrowly obovate, reaching to the apex of the first abdominal segment; halteres small, clavate and slender; legs very long, the posterior tibiae not thickened nor spurred; the proximal joints of the tarsi very long, ungues and pulvilli very small. Abdomen with seven dorsal and six ventral segments (exclusive of the base supporting the valves of the ovipositor), subcylindric; ovipositor pointed obliquely downwards, composed of a stout basal joint terminated by a pair of acute short lanceolate lamellae enclosing a smaller pair of spicules. Male unknown.

The larvae probably feed on Enteromorpha. The species is found on the Kerguelen Island. Type of genus is H. amphibius, Eaton.

This genus is akin to Coryneneura, from which it is separated by its two-jointed palpi, the comparative nakedness of its antennae, its entire eyes, the spurless tibiae of which the hind pair is not thickened, its rudimentary wings, and perhaps by the number of abdominal segments. If the portion reckoned above as the base of the ovipositor be regarded as a segment, then there is no difference between these genera in that last particular.

All the known species of Corynoneura are extremely minute. In the original diagnosis the number of the segments was said to be five; they were enumerated from below, and the proximal segment was taken to be metathoracic.

The foregoing description is taken from Verrall's article in Phil. Trans. of the Royal Soc. of London, vol. 168, p.246. The figures on pl.37 are also copied from Verrall. No North American species.

Genus 13. Psamathiomyia Deby

Journ. Royl. Micr. Soc. 180. 1889. (Pl.35, figs. 4 to 9)

This genus was erected for a small Dipteron found in abundance during the latter days of April, 1888, at Biarritz in the south of France. The following is an abstract of Mr Deby's paper:

Psamathiomyia pectinata is a marine insect, living below water during its early existence, the larva feeding on Enteromorpha. The adult escapes from the pupal case while the descending tide has laid bare the algae covered rocks; these small insects swarm at such times, being especially active when the sun shines on them. The males are more numerous than the females, and are also much more rapid in their motions. . . . Both sexes have rudimentary wings, quite useless as organs of flight, so that these insects cannot possibly escape from the rising tide, which on this coast is accompanied by heavy surf and breakers. It is presumed that the life of the imago does not exceed the few hours during which the tide has receded. Several specimens which were immerged in a vial of sea water were immediately drowned. These insects being small have to be looked for with attention, but once discovered they are easily recognized; the black, very long-legged males look like minute spiders, while the dingy brown louse-like females, which they drag after them, have the appearance, from a distance, of the cocoons some spiders carry behind them.

Generic characters. Antennae (fig.6) six-jointed in both sexes, three middle joints submoniliform, neither feathered nor plumed, much shorter than the thorax and head; mesonotum (fig.9) cucullate, projecting over the head; legs very long and slender, especially in the males, the terminal joint of the tarsus being

furnished (along with the usual claws) with a special finger-like projection, extending over and between the claws, while a doubly curved curious comb-like appendage faces it from below (pl.35, fig.8).

Wings rudimentary (figs.4 and 5); much smaller in the females than in the males; wings without nervures. Halteres distinct (fig.7). The convex eyes are distant in both sexes but fartherest apart in the females. Both the claws on the end of the tarsi of the male are deeply cleft or bifid (fig.8), those of the female being simple. The comb-like appendages are similar in both sexes.

The external genitalia of the male consist of a powerful two-jointed pair of forceps, the lower joints of which are large, massive, subglobular, while the terminal joints are small and linear, and so articulated to the first as to curve inwardly between them when not in use. These terminal joints of the forceps carry at their tips an armature of short, sharp, scattered, horny spines. The ovipositor of the female is conical, narrowing towards the acute apex; it is constituted of two lateral plates or valves, which cover and protect two very delicate, parallel, acute, membranous spiculae.

Mr Deby further gives an extended description of the species, and a plate of eleven figures showing details of structure. The figures of the wings, the thorax, and the foot of the male are here reproduced on pl.35.

Of the remaining figures, that of the male forceps is like that of Eretmoptera browni Kellogg, shown in fig.24, pl.35, excepting that the basal joint of the latter is somewhat longer; and the legs of the male of Psamathiomyia are shown as being proportionately longer than in the American species. Of the structural specific characters the following are of especial importance. The eyes are prominent and convex; the facets are large and hemispherical; the ocelli are absent. Each eye carries at its posterior lateral edge a black chitinous appendage of an oblong shape and of unknown use. The palpi are conspicuous, two-jointed, the terminal joint rich in sensory bristles. The empodium of both sexes is deeply fringed by a series of lengthened simple as well as forked or bifid teeth upon its outer edge, while its inner edge is quite smooth. The tergites of the

abdomen in both sexes number eight. Length of the male about 4 mm.; of the female 4.5 mm.

The larva. The larva of Psamathiomyia is linear, vermiform, and of a yellow color. The apparent number of segments of the body, including the head, is twelve, one for the head, three for the thorax, and eight for the abdomen. The thoracic segments are shorter than the following; the apical one, into which the head is retractile, being the smallest. The thoracic anterior inferior angles of the somites carry inconspicuous minute bristly tubercles, while the abdominal segments, with the exception of the first and of the anal segment, are supplied in the same place with prominent rounded elevations or cushions which infringe on the anterior edge of the preceding segment. These appendages carry nine to ten parallel rows of very minute dark colored teeth, giving them the resemblance to microscopic currycombs. In front of each row of these teeth and standing at some distance one much stouter spine is visible. The anal segment terminates in five conical and somewhat incurved fleshy appendages, one of which is ventral and much larger and broader than the others. This appendage carries near its apex a large bunch of short-curved bristles, while those opposed to it bear several tufts of similar bristles, and the intermediate appendages are quite glabrous. The total length of this larva is 5.10 mm. The length of the anal segment, including its appendages, is .66 mm., that of the three thoracic segments .66 mm., while the middle segments of the abdomen measure .45 mm. in length by .90 mm. in width. The chitinous mandibles are distinctly visible; they appear, as far as can be made out, to be widely three-lobed or toothed, and to be in communication with two long internal chitinous rods, with slightly swollen heads, which terminate as far back as the last thoracic segment.

Pupa of the male. The pupa case, after the imago has escaped through a dorsal slit in the mesonotum, shows distinctly the three sternal divisions of the thorax, as well as the various segments of the abdomen. These are eight in number, unless the anal terminal process is considered as a segment, in which case the abdomen has nine segments. The sheaths of the legs are quite free, bag-shaped, distinctly jointed, rounded at the ends.

The hinder ones are convolute. The mesonotum shows a median transverse depression. The total length of the pupa is 4.5 mm.

Genus 14. Clunio Haliday

Natural History Review II, Proc. 62. 1855. (Pl.36, figs. 11, 12, 13)

Small ferruginous species, characterized by their one-jointed palpi and rudimentary proboscis.

The head is rounded and placed low; proboscis rudimentary, the palpi one-jointed. Antennae 11-jointed, the first two joints spherical, the third much elongated, the following rounded, scarcely hairy, the last joint quite long. Front broad at the vertex with a small protuberance; ocelli wanting or at least rudimentary; eyes round, somewhat hairy; mesonotum oval, overhanging the head, no transverse suture; scutellum semicircular; the metanotum moderately large. Abdomen shorter than the thorax, the segments crowded together, the last one broadened; the genitalia longer than the rest of the abdomen. Legs moderately long, anterior pair widely separated from the others; tibiae with a spur; the metatarsus elongated, the fourth joint smallest; claws and pulvilli well developed. Halteres leaf-like. Wings comparatively large, anal angle prominent. The venation of the type shown in the figure.

According to the Abbe Kieffer (1898 p.107, footnote), the figure of Haliday and here reproduced is not entirely complete. He says, "Le dessin de Haliday ne représente par la premiere ni la derniere nervure; en outre le rameau inferieur de là 4e fait un angle aigue avec le rameau superieur. . . ."

Of the female and of the life history the following is given by G. H. Carpenter (1894) p.129.

We discovered quite a colony of Clunio marinus Haliday on a mass of green sea-weed (Cladophora) covering a rock which had been left exposed by the tide. On some of the weed with the insects upon it being placed in a tube and examined, it became clear that we had now secured both sexes, for two of the males were carrying about with them (attached *in cop.*) wingless females. These when captured had their abdomens distended with eggs, and appeared of a dull greenish color. The female Clunio is much degraded (fig.13). Not only are the wings reduced to very small vestiges, but the legs are weaker,

and the antennae are shorter and of fewer joints (7) than are those of the male (whose antennae are 11-jointed). The male, by means of his strong claspers (so marked a character of the species), was able to hold the body of the female out in a straight line with his own, and thus carry her about; so that when he walked on the glass of the tube her legs could be seen kicking freely in the air.

During the next day each of the females laid about seventy eggs, enclosed like those of Chironomus in a gelatinous tube. The egg is narrowly spindle-shaped, and measures 0.16 mm. in length. By the morning of the second day egg-laying seemed to have finished, and the body of the mother became much shrivelled up. As in both sexes the mouth parts are vestigial, it is probable that life in the imaginal state is short.

Further examination of the Cladophora revealed a larva of the Chironomid type, which there can be little doubt is that of Clunio (fig.11). This larva (4 mm. long) is, excepting the head, which is brown, of a green color, closely agreeing with the sea-weed on which it feeds and lives. The head bears two deep black ocelli on each side (the posterior much larger than the anterior) and a pair of two-jointed antennae. The mandibles are powerful, armed with teeth, and articulated so as to move in almost vertical planes, though somewhat inclined inwards. They act, in conjunction with the serrated labial plate, as scissor-like cutters. There are twelve body segments, the first and last of which are each provided with a pair of sucker feet, the anterior pair armed with numerous spines, and the posterior with a few hooks. This larva has not the ribbon-like appendages and special breathing processes found in that of Chironomus. Chevrel (1894) states that the female has no halteres; that the labium of the larva has six or eight teeth, and that the last abdominal segment of larva has two long divergent setae. No North American species have been recorded.

GROUP TANYPUS

Tanypus Meigen. Illiger's Mag. 2:261. 1803

This group includes the genera Procladius, Anatopynia, Ablabesmyia, Isoplastus, Tanypus and probably also Pentaneura, Podonomus, and Heptagyia.

Eggs. The egg masses of the group Tanypus doubtless vary as much in form and manner of deposition as do those of Chironomus. The eggs of one species of Tanypus are described by Hammond (Postal Microscopical Journal) as circular gelatinous masses, adhering to floating objects. The eggs are arranged in double rows, along about eight straight and parallel lines which extend across the disk (pl.31, fig.11). I have caught female specimens of a species of Tanypus (A. monilis) while laying eggs and found still attached to the abdomen a string of eggs, resembling that of Ceratopogon (Sphaeromyas) argentata. From an examination of the dried egg strings it appears that in this species the eggs are arranged transversely, the egg string being about 1.5 inches in length.

Larva. All the species of this group agree, as far as I am aware, in having an elongate cylindrical body, a more or less elongate head, a somewhat enlarged thorax and distinctly marked abdominal segments, to the last of which are attached the legs. The head in some species is narrow and slender, over twice as long as wide, and in others less than 1.5 times as long as wide. The eye spots are situated on the sides of the head a little cephalad of the middle. The antennae are more or less elongate, in some species quite long and slender, in others short and stout, varying in length from less than 1.5 to over three times as long as the mandibles. The basal joint ranges from two-thirds to nine-tenths of the entire length; the second joint is usually slender, the third and fourth very minute. At the apex of the first joint (at the base of the second joint) is a slender process nearly or quite as long as the second joint. The antennae are retractile to about the apex of the long basal joint, extending back into sockets in the head. They are retracted by special muscles, and extended again by blood pressure. Meinert (1882) was the first to call attention to the retractile antennae of Tanypus larvae. The labrum is broad, truncate in front, smooth on the dorsal surface, the under surface delicately haired. In some species I have observed several pairs of very slender jointed appendages (pl.20, fig.6). I have discovered no part which is comparable to the epipharynx in Chironomus.

The mandibles are rather broad at the base, considerably curved and prolonged into a long apical tooth, the mesal teeth being short and sometimes indistinct or wanting. The maxilla consists of a broad, more or less square, fleshy process, with hairs or filaments projecting cephalad and mesad (pl.19, fig.1 *mx.*), and a prominent palpus (p) with a short basal joint. The palpus is provided with several papillae or apical processes.

The hypopharynx consists either of a horseshoe-shaped piece having a toothed margin (pl.20, figs. 1h and 6h), excepting the middle section, or of two curved pectinate pieces, their tips nearly touching each other; besides this there is a pointed slender lobe (figs.1x and 6x) on each side of the labium. The labium usually has five, though sometimes but four, marginal teeth, differing slightly in shape in the different species. The thorax is somewhat larger in diameter than the abdominal segments, and its three segments not so sharply separated. The anterior prolegs are quite long and slender. They have a long common base, and two branches, at the ends of which protrude the retractile claws. These claws are comparatively few in number, quite distinct, and not hair-like like those of Chironomus. The abdomen has nine segments and is in some species provided with lateral cilia. To the last segment of the abdomen are attached the abdominal legs and appendages (pl.19, fig.10). On the dorsal surface, and attached to the posterior margin of the ninth segment, are two moderately slender cylindrical processes, about three times as long as wide, each with a crown of six or eight long setae at the tip; between the posterior legs is a pair of pointed blood gills (b), and immediately dorsad of this pair is another pair. Often also there is a pair of long setae dorsad of the upper pair of blood gills. The anal feet are long and stilt-like, Degeer comparing them to wooden legs. The claws are slender, each usually with a basal tooth (pl.19, figs. 11 and 12), and are retractile. Blood worms are greedily devoured by Tanypus larvae. The alimentary canal has a reddish tinge, which suggests that the larva preys upon the small red worms known as Tubipex or some other small creature which contains haemoglobin in its blood. Crustacea actually have been seen alive in the alimentary canal. The tracheal system is better developed than in Chironomus

larvae; but it does not appear to open to the surface. (Miall and Hammond, 1900.) Tanypus larvae are said to make tubes like those of Chironomus, but in captivity they seldom seem to do so.

Pupa. Greatly resembles that of Culex, but differs in the form of the breathing trumpet, the form of the caudal fin, and in lacking the stellate hairs on the posterior margin of the thorax. It often remains below the surface but can come up to breathe. When alarmed it sinks and often holds on to objects at the bottom of the water by means of its tail. The pupa is further provided with suckers on the abdomen, which enables it to hold on to solid objects. Meinert (1886) says that the suckers are circular depressions outside the dorsal shields of the abdomen. The pupa of Tanypus varius shows them most distinctly. Here they are borne in pairs by four abdominal segments (3-6). When the pupa has attached itself by a single sucker, it can turn about without losing its hold. The form of the pupa is shown on pl.19, fig.8. The thorax is large and bulky, the abdomen slender and curved under the thorax. The breathing trumpets vary in the different species (figs. 2, 3, 7, 13, and 18); in some species they are long, slender, cylindrical, and tube-like; in others spindle-shaped or funnel-shaped; and in one an elongate ellipsoid with a small aperture. The surface may be smooth, spinose, or reticulate. On the dorsum of the thorax back of the trumpets there is, in some species at least, a row of short spines (pl.19, fig.8). The wings, legs, antennae and eyes of the adult are distinctly visible in the more mature pupae. There are seven abdominal segments besides the anal to which the caudal fin is attached. There are no distinct spinose markings in the species which I have examined. The caudal fin varies with the different species; in some it is composed of two pointed projections, in others these are more lobe-like, while in an extreme form it is in the form of a rounded paddle (pl.19, figs. 4, 6, 15, 19, and pl.20, figs. 4 and 8).

The imago. Body elongate and pubescent. Eyes separate in both sexes. Palpi four-jointed, curved, first joint shorter than the second, second shorter than the third, fourth nearly as long as the second and third. Antennae in both sexes fifteen-jointed, filiform, seated in a notch in the eyes; plumose in the male, joints two to thirteen very small, fourteenth long, fifteenth short and

conical; in the female the antennae are pilose, the fifteenth thicker than the others, pubescent and more acuminate. Thorax elevated, with a depression in front of the scutellum, scutellum rather small; metathorax with a longitudinal furrow. Abdomen composed of eight segments, long, hairy; more hairy and longer in the male than in the female. Wings often pubescent, hairy along the hind border, the subcostal vein ending beyond the middle of the wing, vein R_1 ending about two thirds the length; vein R_{2+3} emerging from the crossvein and the lower branch (R_3) ending at beyond three fourths the length; vein R_{4+5} also proceeding from the crossvein, ending a very little in front of the tip; cubitus forked as usual, the M-Cu crossvein present. Legs long and slender, pubescent, unarmed; coxae of moderate size, claws very small; in the male the fore tarsi are often pilose, in the female always bare.

The group Tanypus which is equivalent to the genus of Meigen (1803) has been divided by Skuse (1889) into three genera, Procladius, Isoplastus, and Tanypus sens. str. Skuse proposed to retain the name Tanypus for those species in which the wings are hairy and in which the fork of the cubitus is proximad of the M-Cu crossvein. This cannot well be maintained since Meigen (1803) gives cinctus Fabr. (=punctipennis Meig.) as the type species, and it possesses hairy wings and the fork of the cubitus distad of this crossvein (i. e. petiolate). I therefore suggest retaining the name Tanypus for the last-mentioned division and propose the name of Ablabesmyia for the former. Skuse has already provided for the bare-winged species with the fork of the cubitus petiolate the name Procladius. Isoplastus applies to an Australian genus. There remain still the species having bare wings with fork of the cubitus proximad of crossvein, for which I propose the name of Anatopynia. These new genera will be more fully characterized farther on.

Genus 15. Procladius Skuse

Proc. Linn. Soc. N. S. W. 4:283. 1889
Tanypus Meigen, pt. 1803

Antennae in the male 15-jointed. Wings naked. R_2 and R_3 distinct. Fork of the cubitus short, its base lying midway between the M-Cu crossvein and the tip of its posterior branch

(pl.37, fig.12). In some species petiole of the cubitus is very short (pl.27, fig.4).

The only larva which I have found belonging to this genus is that of a d u m b r a t u s n. sp. (pl.20, figs.1-5). Pupae of the above species and of P. p i n g u i s Lw. will be found described upon a subsequent page (pl.19, figs.3-4, and pl.20, figs. 4 and 5).

KEY TO SPECIES OF PROCLADIUS

Imagines

a Legs uniform in color, pale or dark

b Legs piceous or brownish; fore metatarsus about one sixth shorter than the tibia; opaque black species, thorax cinereous, black striped; crossvein lightly cinereous; wings white; halteres white; length 4.5 mm. ..... 1. t u r p i s Zett.

bb Legs yellow; brown species, prothorax, a spot near its humerus and scutellum dark yellow; length 4.5 mm. (Colorado) 2. o c c i d e n t a l i s

aa Legs bicolored

b Yellow or red dorsum of thorax (usually pale species)

c Scutellum and metanotum yellow, the latter sometimes with a line of black

d Small yellowish species; thorax whitish with three shining reddish stripes; length 1.5 to 2.25 mm. ..... 3. p u s i l l u s

dd Larger yellow species, 3 mm. ..... 4. b e l l u s

cc Scutellum and metanotum, either one or both, with considerable black upon them

d Tips of fore femora black; abdomen black and fusous; male, length 4.5 mm. ..... 5. t h o r a c i c u s

dd Fore femora not as above

e Fore femora wholly yellow; abdomen yellow; segments with black bases; female, length 3 mm. ..... 6. c o n c i n n u s

ee Fore femora black and yellow

f Femora black, bases yellow; male abdomen black and white; female abdomen black; male fore tibia white with black tip; female fore tibia black; length 3 mm. (Cuba) 7. h u m e r a l i s

ff Femora and tibiae yellow, each with two black rings; abdomen black and yellow; female, length 3.5 mm. 8. t r i c o l o r

bb Black or fuscous dorsum of thorax (dark species)

c Femora more than half yellow

d Abdomen wholly dark brown subshining; thorax shining brown, with three shining dark brown stripes; tibiae nearly wholly brown; halteres sordidly yellow; female, length 3.5 to 4 mm. 9. c a l i g i n o s u s n. sp.

dd Each abdominal segment basally or apically yellow

c Thorax pitchy black; pleura ferruginous; abdomen black; bases of segments yellow; male, 3 mm. ..... 10. f l a v i c i n c t u s

ce Thorax and pleura with three wide dull dark brown or black stripes; abdomen brown, each segment with a yellowish posterior margin; length 2.5 mm.; female
11. adumbratus n. sp.

cc Fore femur black, excepting the immediate base

d Middle femora yellow; abdomen shining black; female, length 3.3 mm. ..... 12. pinguis

dd All femora black with white bases; thorax black; pleura with upper half white; female abdomen black; male abdomen white and black ..... 13. scapularis

1. Tanypus (Procladius?) turpis Zetterstedt

1838 Chironomus Zett. Ins. Lappon. 811.
1850 Tanypus Zett. Dipt. Scand. IX. 3596

Dusky cinereous, opaque, dorsum of thorax with three black stripes; antennae brown; wings and halteres white, the crossvein fuscous; legs brown; the fore tarsus of the male short pubescent, its metatarsus about one sixth shorter than the tibia. Length of male 5 mm; female 4 mm.

Male and female. Head dark. Antennae of the male brown, paler at the tip; that of the female yellow with a brown apex. Thorax cinereous, with three rather wide blackish stripes, the median one abbreviated posteriorly and continued by a fine dark line to the cinereous scutellum; metathorax blackish.

Abdomen black, that of the male slender, pilose, the last three segments with little wider pale margins, the caudal appendages small, slender, and incurved; in the female the abdomen is a little stouter and pubescent. Wings white, bare, the anterior veins subtestaceous, the remaining veins slender and white, the oblique R-M crossvein subfuscous; the perpendicular M-Cu crossvein is slender and spotless. Legs rather slender, wholly brown or pale, slightly pubescent. Fore tarsus a little shorter than the tibia, the second tarsal joint one half as long as the metatarsus, the remaining joints gradually decreasing in length. (This species may possibly belong to the genus Anatopynia.) Greenland, New Jersey (Johnson, 1904).

2. Procladius occidentalis Coquillett

1902 Tanypus Coq. Proc. Nat. Museum. 25:92

Brown, the prothorax, a spot near each humerus, and the scutellum dark yellow, legs light yellow, halteres whitish; hairs of antennae brown and yellow, wings hyaline, bare, first vein not connected with the second by a crossvein (i. e. R_2 and R_3 coalescent); fifth vein (cubitus) forks a short distance beyond the crossvein, the latter situated nearly its length before the small crossvein; length 4.5 mm. A male specimen. Colorado, New Jersey (Johnson, 1904).

3. Procladius pusillus Loew

1866 Tanypus Lw. Berl. Ent. Zeit. 4

Male and female. Very pale yellow, the thoracic stripes and the metanotum ochreous red, each abdominal segment with a fuscous basal fascia, wanting or indistinct in the female, the legs white, the extreme tips of the tibiae and the apical ends of the tarsi black, the fourth tarsal joint simple, wings bare, subhyaline, the crossvein subfuscous. Length 1.5 to 2.3 mm. Wing 1.5 to 1.8 mm. Much resembes T. bellus, but is paler and smaller.

The head is pale, the disk of the occiput red, antennae fuscous, in the female with pale base; in the male the hairs subfuscous. Thorax pale yellow, with three red stripes, the median one posteriorly much abbreviated and often divided by a fine line, lateral ones much abbreviated anteriorly. Metanotum and the upper half of the pleura red; the pleura are sometimes wholly red. Scutellum yellowish. Abdomen of the male whitish, each segment with a fuscous basal ring; the abdomen of the female is sometimes wholly white or pale yellow, sometimes with lateral subfuscous spots, rarely each segment with a subfuscous ring. The legs are white, short pilose, extreme tips of tibiae black, the tarsi marked like P. bellus Halteres white. Wings bare, subhyaline transverse vein subfuscous or fuscous. Washington D. C. (Pl.27, fig.1).

To the above description may be added that the tips of two or three joints of the tarsi are blackish, the fourth and fifth tarsal joints infuscated. Fore metatarsus about one-third shorter than its tibia. Specimens from Ithaca, N. Y. Michigan.

4. Procladius bellus Loew

1866 Tanypus Lw. Berl. Ent. Zeit. 4

Male and female. Pallidly yellow, the thoracic stripes and the metanotum reddish, pleura and pectus red and fuscous variegated, the abdomen black annulate, the tarsi towards the tip, and the extreme tips of the tibiae black, the next to the last tarsal joint normal, the wings bare, subhyaline, the transverse veins fuscous. Length 2.7 to 3 mm. Wings 2.5 to 2.7 mm.

The head pale or dilutely clay yellow, the disk of the occiput ferruginous, the antennae of the female pallid, blackish towards the tip, that of the male subfuscous, with basal and apical joints black, with pale pile. Dorsum of thorax pallidly yellow, with three reddish stripes, the median one much abbreviated posteriorly and divided by a very slender pale line; the lateral stripes much abbreviated anteriorly. Scutellum pallidly yellow. Metanotum reddish or ferruginous, often marked with a fuscous

median line. Pleura variegated reddish and fuscous. Abdomen pallid, each segment with a black or fuscous basal fascia, wider on the more posterior segments. The legs covered with whitish or pale yellow pile; the extreme tips of the tibiae are black; the first pair of tarsi are black from the tip of the metatarsus onwards, the base, however, of the second joint in the male being pallid; the second and third pairs have pale first and second joints excepting the extreme tips; the remaining joints are black, though in the male the base of the third joint is pale. The fourth tarsal joints are all simple and sublinear. Halteres white. Wings bare, subhyaline, crossveins fuscous or black. Washington D. C. (Loew.) Fork of cubitus petiolate. (S. Henshaw, in litt.)

5. Procladius thoracicus Loew.

1866 Tanypus Lw. Berl. Ent. Zeit. 4

Male. Reddish, shining, flagellum of the antenna, scutellum, and abdomen, excepting the base of each segment, black fuscous, the legs yellowish, the tip of each tibia and each tarsus, excepting the base, black, the fourth joint of the latter short, that of the middle and hind pairs obcordate, the wings bare, subhyaline, the crossveins fuscous. Length 4.5 mm. Wing 3 mm.

Head yellowish red, the first joint of the antenna the same color or dusky red, the flagellum and its hairs fuscous. Thorax reddish, shining, the color of the humeri verging upon yellow, the scutellum blackish fuscous, the metanotum reddish or subfuscous. Each segment of the abdomen with fuscous black unevenly distributed, so that often they are wholly black excepting the basal joints. The legs are pale yellow, the extreme tips of the fore femora and of all the tibiae are black, the fore tarsi have the last four joints and the apical third of the first joint black; the middle and hind tarsi from the tip of the second joint are black; all the fourth tarsal joints are short, those of the second and third pair of legs are obcordate. Halteres white. Wings bare, subhyaline, crossveins fuscous. Washington, D. C. (Loew.) Fork of cubitus petiolate. (S. Henshaw, in litt.)

6. Procladius concinnus Coquillett

1895 Tanypus Coq. Proc. Acad. Nat. Sc. Phil. 308

Light yellow, three vittae on the thorax reddish yellow, the middle one bordered each side with black, the lateral ones changing into black posteriorly; a dot at each front angle of the scutellum, middle of metanotum, a fascia at base of each abdominal segment except the first, apices of tibiae, of metatarsi, of the second joint of middle and hind tarsi, the whole of the remaining joints and the last four of the front tarsi black.

Penultimate joint of hind tarsi obcordate, as broad as long. Wings naked, whitish hyaline, veins pale yellowish, small crossvein clouded with brown, first vein forked before its apex, the fifth (cubitus) forking slightly beyond the crossvein. Length 3 mm. Female. Tick Island, Florida.

7. Procladius humeralis Loew

1866 Tanypus Lw. Berl. Ent. Zeit. 3

Male and female. Reddish, the humeri and the upper half of the pleura white, the pectus and metanotum fuscous, the legs white and black variegated, the wings bare, with a central black spot which covers the crossveins, the penultimate tarsal joint short, obcordate.

Male. The abdomen white and black ringed, the fore tibiae white except the tip.

Female. The abdomen wholly black, the fore tibiae wholly black. Length 2.7 mm. to 3.3 mm. Wing 2.5 to 2.7 mm.

Head white, the disk of the occiput fuscous. The antennae fuscous, of which the flagellum of the male is paler. The thorax red, in the male opaque, in the female somewhat shining and often more deeply colored; the collar, humeri and upper half of the pleura in both sexes white, though the color is less pure in the female. The pectus and metanotum fuscous black. The abdomen of the male is black, but the first two segments, the tip of the third and fifth, and the fourth and sixth except the base, are white. All the femora in both sexes excepting the white bases are black or pitchy; the fore tibiae of the female are of the same color, those of the male are white with black tips; the middle tibiae of the female are usually black, rarely with a fuscous ring; those of the male are white with black tip and base; the hind tibiae except base and tip are white in both sexes; the fore tarsi are black, the first joint is white except the tip, in both sexes; in the male the base of the second is often lutescent; the first two joints of the middle and hind tarsi of both sexes are white, with black tips, the remaining joints being wholly black; all the fourth tarsal joints short, obcordate. The wings are bare, subhyaline, with a small black spot covering the crossveins and anastomosing with a minute spot on the cubitus. Cuba. (Loew.) Fork of cubitus sessile. (S. Henshaw, in litt.) May possibly belong to Anatopynia.

8. Procladius tricolor Loew

1861 Tanypus Lw. Berl. Ent. Zeit. 309

Female. Yellowish, the thorax with reddish ferruginous stripes, fuscous marginate, the abdominal segments with black bases and yellow posterior margins; the legs black-ringed; the wings hya-

line, bare, the longitudinal veins pale, the crossveins fuscous black and fuscous bordered. Length 3.5 mm. Wing 3.75 mm.

The head is very pale yellow. The palpi fuscous. The antennae are short, fuscous, with the scapus (basal joints) pale yellow. The humeral spots of the thorax and the pleura are pale yellow; the dorsal stripes are confluent, reddish ferruginous, and fuscous marginate. The scutellum is fuscous, with a yellow median line. The metanotum is fuscous black; the pectus ferruginous. The first segment of the abdomen is wholly yellow, the second is yellow with a fuscous base; the remaining segments are black, each with a yellow posterior margin. The legs are yellow, black annulate; the median ring of the femur is wide but somewhat faint, the apical ring narrower and distinct; the tibial rings are distinct, the sub-basal one wide, the apical one narrow. The fore tarsus from the tip of the first joint is black, the middle and hind tarsi each have the tip of the first joint and all the following joints black. Halteres pale yellow. Wings hyaline, bare, the longitudinal veins are yellowish, the crossveins are fuscous black with a fuscous border. New York. (Loew.) Fork of cubitus sessile. (S. Henshaw, in litt.) May possibly belong to Anatopynia.

9. Procladius caliginosus new species

(Pl.27, fig.2)

Female. Dark brown, somewhat shining, with robust body. Wings bare, slightly smoky, crossvein clouded. Length 3.5 to 4 mm.

Resembles P. p i n g u i s Loew, differs from it in having the antennae wholly fuscous, and in having the tibiae nearly wholly brown. The head, mouth parts and antennae wholly fuscous, vertex, shining. Dorsum of thorax shining brown, with three shining dark brown stripes, the middle one divided. Scutellum and metanotum shining dark brown. Pleura pale brown, sternum darker brown. Abdomen wholly dark brown, subshining. Coxae pale, trocanters and femora yellow, the apical one third of the first pair of the femora and the apical one fourth or one fifth of the second and the third pairs brown; tibiae brown, the middle section of the middle pair slightly paler, the hind pair with a broad yellowish band beyond the middle. Tarsi brown, the basal two thirds of middle and hind metatarsi yellowish. Fourth tarsal joints obcordate. Wings slightly smoky, particularly along the course of the veins; anterior veins brown, crossvein clouded with brown. R_2 present, crossvein like, near the tip of R_1. The cubitus forks a little beyond the M-Cu crossvein. Halteres sordidly yellow. Fore metatarsus about 0.6 as long as its tibia. Several specimens, Ithaca, N. Y.

10. Procladius flavicinctus Loew

1861 Tanypus Lw. Berl. Ent. Zeit. p.309

Male. Pitchy black, shining; the base of each segment of the abdomen yellow; the wings hyaline, bare, the heavier veins fuscous; halteres white; legs yellow, the tips of the fore and hind tibiae and the apical half of all the tarsi black. Length 3 mm. Wing 2.7 mm.

Shining pitchy black. Palpi yellow; face yellow; antennae dark fuscous, its hairs of the same color. Pleura ferruginous. The base of each of the abdominal segments is yellow, the yellow of the anterior ones wide and entire, that of the posterior ones narrow and interrupted. The claspers are obtuse, equalling the seventh segment in length. The legs are yellow, the tips of the fore tibiae widely, the hind tibiae narrowly, black-ringed, the fore tarsi from the tip of the first joint, the middle and hind tarsi from the tip of the second joint onwards are black. The wings are bare, hyaline, very faintly cinereous, the more delicate veins testaceous, the heavier ones fuscous. Pennsylvania. (Loew.) Fork of cubitus petiolate. (S. Henshaw, in litt.)

11. Procladius adumbratus n. sp.

(Pl.20, figs. 1–5)

The larvae were collected in July and October in Eddy Pond, Ithaca N. Y. The larva is a buff yellow, mottled more or less with brownish spots. Length about 5 mm.

Head short, about one and one-half times as long as wide, brownish, antenna about one-fourth longer than the mandible, its basal joint more than three-fourths the entire length. The eye spots black, simple. Mandible rather slender, apical tooth sharp, black tipped; the lateral teeth small and indistinct. Maxilla large, with a prominent stout palpus. Hypopharynx composed of a pair of curved pectinate chitinous branches apparently connected in the center by membrane (fig.1, h). Labium (l) with five teeth, the laterals a little longer than the median. The lateral margins of the abdomen fringed with long but very delicate pale hairs. Anterior legs with numerous, short, curved, but not pectinate claws. The posterior claws are of two kinds, the centrals long and slender (fig.2), and the marginals short and flattened (fig.3); all of the same brownish color. The dorso-anal papillae are long and slender, each with ten long brownish setae. The four anal blood gills are pointed and slender, but not as long as the anal prolegs.

The pupa is brownish; length about 3 mm. Respiratory trumpets slender (fig.5), about as long as one of the abdominal

segments, the surface with minute, pointed, chitinous scale-like projections. Body smooth and hairless; the abdominal segments under the highest magnification minutely punctate; the lateral margins of the last two segments with four or five pale, slender filaments. The caudal fin (fig.4) with rounded paddle, and with small, short, marginal setae.

The imago, female. Head, including front, vertex, back of head, orbit, and basal antennal joint, yellowish. The second antennal joint and a triangular spot on vertex polished black; the remaining antennal joints, the dorsal surface of proboscis and palpi deep fuscous. Thorax, including pleura and pectus, yellowish like the head, the last sometimes blackish; the dorsum with three dark brown or black longitudinal stripes, the middle one divided; scutellum and metanotum blackish. Abdomen fuscous, each segment with a wide dusky yellow, posterior margin; venter dusky yellow, the hair of scutellum and the first abdominal segment stiff and black, the remaining abdominal segments with yellowish hairs. Legs yellowish, the tips of the tibiae and of the metatarsi, and the whole of the remaining tarsal joints subfuscous or blackish. Fore metatarsus about two thirds as long as its tibia. Fourth tarsal joint obcordate.

Wings subhyaline, hairless, the radial veins yellow, the basal part of the media and cubitus as far as the crossveins dusky, the latter also darkened; the other veins pale; R_2 present, near the apex of R_1; the cubitus forks far distad of the crossveins. Halteres pale yellow. Length $2\frac{1}{2}$ mm. Ithaca N. Y.

12. Procladius pinguis Loew

1861 Tanypus Lw. Berl. Ent. Zeit. p.308

(Pl.27, fig.3; pl.19, figs. 3 and 4)

The larva is of a reddish color of almost as deep a shade as a Chironomus larva. The single larval skin was lost. The pupa is fuscous; its respiratory trumpets are white, comparatively large, with the free end open and larger in diameter than at any other point. The surface quite smooth. The abdomen is nearly devoid of setae, excepting the margin of the last two segments, which are as shown in fig.4, pl.19; each with about five filaments on each side. The caudal fin is nearly circular in outline with a V-shaped notch at the apex, margin ciliate.

The imago, female. Black, shining; wings cinereous hyaline, bare, the heavier veins dark fuscous; halteres white; first pair of legs pitchy black, bases of femora yellow; middle and hind legs

yellow, the extreme tips of the tibiae and the apical half of each tarsus black. Length 3.3 mm. Wing, 3.1 mm.

The species resembles T. nervosus (European), but the yellow base of the antennae and the white halteres distinguish it with certainty. Shining pitchy black, palpi fuscous; face and front sordidly ferruginous; antennae fuscous, the scapus and the basal joints of the flagellum yellow. Pleura ferruginous; pectus yellow. The fore legs pitchy black, the coxae and basal third of each femur yellow; the middle legs yellow, the bases of their tibiae infuscated, the tips of the tibiae and the part of the tarsus from the tip of the metatarsus fuscous black; the hind legs yellow, the tip of tibia and the part of tarsus beyond the tip of the second joint fuscous black. Halteres yellowish white. Wings cinereous hyaline, bare, the more delicate veins pale fuscous, the heavier ones dark fuscous. New York.

To the above description may be added that in a newly emerged specimen the dorsum of the thorax is distinctly striped, with the space between the stripes yellowish. The fourth tarsal joint is longer than the fifth, and but little broadened. Legs sparsely haired. Fore tibia about twice as long as its metatarsus. Wing venation as figured. One bred specimen. Ithaca, N. Y.

13. Procladius scapularis Loew

1866 Tanypus Lw. Berl. Ent. Zeit. p.2

(Pl.27, fig.4)

Male. The abdomen white and black annulate, the fore tibiae and the fore metatarsi white excepting their tips.

Female. Abdomen wholly black, the fore legs excepting the bases of the femora black. Length 3 to 3.7 mm. Wings, 2.5 to 2.7 mm.

Male and female. Black, the humeri and the upper half of the pleura white, the legs white and black variegated, the wings bare, with a central black spot covering the crossveins, the fourth tarsal joint short, obcordate.

Head white, the disk of the occiput pitchy black; antennae of the female short, fuscous; of the male antennae the first joint is black, the flagellum subfuscous. The thorax of the male is black and opaque, that of the female is pitchy black and subshiny; the humeri, the collar, and the upper half of the pleura white in both sexes. Scutellum same color as the thorax. Abdomen of the male black, excepting the whole of the first two segments, the posterior margin of the third, the posterior four-fifths of the fourth, and the posterior one-half of the sixth, which are

white; the abdomen of the female is wholly black. All the femora excepting their white bases are black, or pitchy black in both sexes; the tibiae and fore tarsi of the female are the same color; those of the male are white, but the tips of the tibiae and the tarsi from the end of the first joint are black. The middle and hind tibiae are white, the base and tip widely black; the middle and hind tarsi black, the first joint except its tip white; all the fourth tarsal joints of both sexes short, obcordate. Halteres whitish. Wings bare, subhyaline, with a small black spot, which covers the crossvein and anastomoses with a small spot (also black) on the cubitus. The female differs in having black middle tibiae each with a white ring. Washington, D. C.

A male and a female specimen, the first from New Jersey, the second from Washington, D. C., in my possession agree perfectly with the above description. It may be added that the basal two-thirds of the antennae and its hairs are pale fuscous, the apical one-third darker.

Genus 16. Anatopynia, new genus

Tanypus Meigen. Illiger's Mag. 1803 (pt.)

Belongs to the group Tanypus. Antennae fifteen-jointed in both sexes; wings bare; R_2 usually present near the tip of R_3; fork of the cubitus slightly proximad of the M-Cu. crossvein. Type of the genus T. plumipes Fries (1823).

To this genus probably belong also the following European species: forcipatus Egger (1863); nudipes Zett. (1850); consobrinus Zett.; lactipennis Zett.; morio Zett.; pubitarsis Zett. The species tricolor Lw. (N. Y.), humeralis Lw. (Cuba) and turpis Zett. (Greenland) may possibly belong in this genus. See descriptions on p. 127, 130. Of this group Meinert (1886) has figured the respiratory organ of the pupa of plumipes.

Genus 17. Ablabesmyia, new genus

Tanypus Meigen. 1803 (pt.); Tanypus Skuse. 1889

Antennae 15-jointed (counting basal joint); wings hairy, the cubitus forks at or before the M-Cu. crossvein.

For this subdivision Skuse (1889) had proposed to retain the name Tanypus Meigen, but this cannot be maintained for the reasons given on p.125.

KEY TO SPECIES OF ABLABESMYIA

Larvae

a Labium with but four teeth, pl.19, fig.5...25. Species from Ithaca, N. Y.
aa Labium with five teeth
b Several claws of the posterior feet stouter and conspicuously darker colored than the others, pl.19, fig.14. Antennae over three times as long as the mandibles.....6. monilis
bb Claws of posterior feet all the same color
c Antennae rather short and stout (pl.20, fig.1) less than 1.5 times as long as the mandible; sides of abdomen fringed laterally with hairs.....Procladius adumbratus (q. v.)
cc Antennae over twice as long as the mandibles
d Teeth of labium of about equal length; antennae three times as long as the mandible, pl.20, fig.6.....4. carnea
dd Not as above
e Mandible stout at base with distinct tooth near apex; basal joint of antenna about two thirds of total length, pl.19, figs. 16 and 17.....22. fastuosa n. sp.
ee Antenna with its basal joint over three fourths the total length, pl.19, fig.1.....16. flavifrons n. sp.

Pupae

a Swimming paddle rounded, not sharply notched at apex
b Trumpet rather elongate, over four times as long as wide; swimming paddle as shown in pl.20, fig.4
Procladius adumbratus (q. v.)
bb Trumpet short (pl.19, fig.3); swimming paddle as shown on pl.19, fig.4.....Procladius pingúis (q. v.)
aa Swimming paddle with two pointed lobes
b Thoracic respiratory organ (trumpet) egg-shaped, with very small aperture, pl.19, fig.13.....6. monilis
bb Breathing organ funnel or club-shaped
c Breathing organ club-shaped, pl.19, fig.2..16. flavifrons n. sp.
cc Breathing organ not of this type
d Swimming paddle rather broad, but little longer than wide, pl.19, fig.6. Trumpet as shown in fig.7.....10. dyari
dd Swimming paddles quite pointed
e Paddle and breathing trumpet as shown on pl.19, figs. 18 and 19.....22. fastuosa
ee As shown on pl.20, figs. 7 and 8.....4. carnea

Imagines

a Wings clouded (banded or spotted)
b Legs nearly uniform in color
c Wings uniformly spotted with fuscous; fuscous species; the thorax with three dusky stripes; legs yellow; length 4.5 mm.; female. (= ?decedens Walk.).....1. pictipennis
cc Smaller paler species; the wings with few large bars or spots
d The first fascia of the wing lies distad of the crossvein; length 2½ to 4 mm.....2. bifasciata

dd The fascia lies proximad or over the crossvein

c The abdominal segments of the male each have brown posterior margins; head brown, 3 mm. ..... 3. futilis

cc The abdominal segments of the male have brownish fasciae or spots near *anterior* margin of each; the female has a brownish abdomen with paler posterior margins to the segments

f Three to five mm. in length; pale yellowish; abdominal fasciae of the male pale brown; dorsal stripes reddish or brown ..... 4. carnea

ff Two and one half mm. or less in length; thorax brownish; dividing lines cinerous ..... 4a. var. a. carnea

bb Legs distinctly bicolored

c Wings spotted but not banded

d Species with brown or black thorax and abdomen, pl.37, fig.17 (Greenland) ..... 5. pulchripennis

dd Pale (reddish or yellowish) species

c Tibia with three rings; femur with one at the tip (=annulatus Say) ..... 6. monilis

cc Tibia not with three rings

f Femur with two brownish rings near the apex; wing with about eleven brown spots (California and New Mexico) 7. venusta

ff Femur with one ring

g Abdomen of male pale yellow, black and brown fasciate; wing with apex from slightly before tip of R_1, grayish brown and containing several whitish hyaline drops; length 5 mm. (Washington) ..... 8. guttularis

gg Abdomen brownish fasciate; wing with apical half with many mostly isolated brown spots; length 3 to 4 mm. (New Mexico) ..... 9. barberi

cc Wing with one or more cross bands

d Femora and sometimes tibiae also with brown bands

c Wing with median band and apical third of wing brownish, marked with several hyaline spots; each femur with subapical ring, tibia with basal ring; length 3 to 4 mm. 10. dyari

cc Apex of wing with band or spot, but no hyaline spots in it

f Wings yellow, humeral crossvein brown clouded, brown fascia across wing and at apex of vein R_1, each femur with apical and tibia with basal band; tarsi white, apical joint brown; length 3 to 3.5 mm. (New Jersey) .. 11. johnsoni

ff A pale brown cloud near the tip of the wing also; length 3 to 5 mm. ..... 12. ornata

dd Femora and tibiae not banded, or with only apices of femora and either bases or apices of tibiae slightly darkened

c Wing with one faint brown band. Yellow species with three thoracic stripes, metanotum, spots on pleura and sternum, brownish black; apices of femora and bases of tibiae brownish; length 3 mm.; female (Alaska) ..... 13. algens

cc Wing with two cross bands and the apex largely brown, these bands containing hyaline spots; apices of femora and tibiae slightly darkened; length 3 mm. (New Hampshire) (compare d y a r i).....14. d i s c o l o r

aa Wings not clouded excepting sometimes the crossvein or a faint smokiness near the apical end

b Pale species

c Species over 3 mm. in length

d Wholly yellowish species.....15. m e l a n o p s

dd Abdomen, at least of the male, with brown fasciae

e Thoracic stripes, metanotum, and sternum brown 16. f l a v i f r o n s n. sp.

ee Thoracic stripes, etc., yellow.....24. n i g r o p u n c t a t a

cc Species less than 2.5 mm. in length

d Thorax not striped; pale yellow species

e Length 1.5 to 2 mm., front metatarsus nearly as long as its tibia; (St Vincent Island).....17. f l a v e o l a

ee Length 1 mm., basal cells of wing short (D. C.) 20. p i l o s e l l a

dd Thorax with longitudinal stripes

e Abdomen pale yellow; the male with segments two to five with a band near the base and nearly the whole of the following segments pale brownish; mouth parts brown; R_2 present near the tip of R_1; length 1.25 to 2.5 mm. (New Mexico). (A variety with yellow mouth parts from New York.) 18. p a l l e n s

ee Not as above; basal cells of wing short

f Species 1.5 to 2.25 mm. long; abdomen brown with ashy posterior margins to the segments; crossvein proximad of the basal third of the wing (New York and St Vincent Island) 19. i n d e c i s a

ff Species 1 mm. in length (Washington, D. C.) 20. p i l o s e l l a

bb Darker species

c Halteres pale fuscous; blackish; legs sordidly yellowish brown; tibiae long-haired; thorax dark; abdomen somewhat shining and fuscous haired; the R–M crossvein near the middle of the wing; length 2.5 mm. (Greenland).....21. t i b i a l i s Staeger

cc Not as above

d Length 3 mm.; metatarsus about 0.6 as long as the tibia; halteres white .....22. f a s t u o s a n. sp.

dd Length 3.5 to 4 mm.; halteres luteous.....23. h i r t i p e n n i s

1. Ablabesmyia pictipennis Zetterstedt

1838 T a n y p u s Zett. Ins. Lappon. 818. (=? T. d e c e d e n s Walker)

1878 T a n y p u s O. S. Cat'l. Dipt. 22

Female. Fuscous black, pilose; the thorax with three dusky stripes; the wings white, uniformly sprinkled with fuscous clouds; the halteres white; the legs yellow. Length 4.5 mm. This species

resembles T. nebulosus (an European species) but is a little smaller, the abdomen is not annulate, the incisures only being narrowly pallid, and the wings are white, uniformly fuscous spotted, hairy. Greenland. (Staeger and Lundbeck.)

T. nebulosus mentioned above is a grayish brown fly about 7 mm. long, with striped thorax and banded abdomen; legs reddish yellow, the tibiae with dark tips and the tarsi dusky; wings hairy, clouded; the fork of the cubitus sessile.

The description of Tanypus decedens Walker p.22. (1848) is as follows: This species resembles T. nebulosus Meigen, but the spots of the wings are much fainter and the tips of the thighs and of the shanks are not dark. Length of the body, 4 mm. Of the wings 10 mm. St. Martin's Falls, Albany River, Hudson Bay Ter.

2. Ablabesmyia bifasciata Coquillett

1901 Tanypus Coq. Proc. U. S. Nat. Mus. 23:609

Male. Differs from johnsoni (see number 11) as follows: Front corners of scutellum brown, apical joint of tarsi white, no brown band on femora, nor on tibiae, brown of abdomen confined to a fascia at base of segments 2 to 6 and middle of dorsum of seventh, (front tarsi wanting), hairs of wings chiefly brown, humeral crossvein not bordered with brown, the first fascia lies beyond the small crossvein; length, 4 mm.

Female. Hairs of antennae whitish, abdomen yellow, destitute of brown markings, otherwise as in the male. Length 2.5 mm. A specimen of each sex.

Habitat. Riverton, N. J. (C. W. Johnson); Pennsylvania; and Boston, Mass.

3. Ablabesmyia futilis Van der Wulp

1868 Tanypus Wulp. Tijd. v. Ent. ser.2. 2 (X), 130

Fuscous; the abdomen white and fuscous annulate; scutellum, legs and halteres pale yellow; wings pilose, clouded and spotted; fork of the cubitus sessile. Male; length, 3mm.

Male. The head is dark brown, on the eye margins with a paler sheen; proboscis and palpi brown; antennae with its hairs yellowish brown. The thorax moderately arched, dark brown, the anterior margin, the humeri, and a pair of longitudinal stripes upon the dorsum with a whitish sheen; scutellum whitish yellow; metanotum blackish. Abdomen transparent whitish, with a broad brown posterior margin on each segment and a blackish brown interrupted longitudinal dorsal stripe; the last segment wholly darkened, somewhat flattened, the last two segments a little broad-

ened; the claspers brownish yellow, as long as the last segment; the hair of the abdomen pale yellow or light brown, very dense and long. Legs unicolored, pale brownish yellow; the coxae alone somewhat darker; the fore tarsi not hairy; the fore metatarsus about one fourth shorter than the tibia; the fore femora upon the flexor surface, as also the whole of the hind legs with a moderately long, delicate, yellowish hair. Halteres pale yellow or whitish. Wings hairy, hence grayish, clouded and spotted; the most conspicuous spot covers the crossveins, another spot nearer the wing tip between the radius and media, another below the crossvein not far from the posterior margin; the humeral crossvein is black; the media is bent downwards a little just before its ending at the wing tip; the fork of the cubitus begins at the M-Cu crossvein and is therefore sessile. Translation from the Dutch of V. d. Wulp. Wisconsin.

4. Ablabesmyia carnea Fabricius

1805 Chironomus Fabr. Syst. Ant. 41, 16
1818 Tanypus Meigen. Syst. Beschr. 1:67, 21
1850 Tanypus Zetterstedt. Dipt. Scand. 9:3620
1864 Tanypus Schiner. Fauna Austriaca. 2:620
1877 Tanypus V. d. Wulp. Dipt. Neerlandica. p.304
1823 Tanypus albipes Fries. Monogr. Tanyp. Suec. 16, 11

(Pl.20, figs. 6, 7, 8)

Larva. Larvae from Ithaca, N. Y. Reddish yellow. Head about three times as long as wide, the antennae slender, three times as long as the mandible, the first joint three-fourths of the total length. The labrum smooth above, hairy beneath, with two short and two more elongate, very slender-jointed papillae. Mandibles slender, apical tooth black tipped, elongate, lateral teeth small and irregular. Maxilla with a stout cylindrical palpus, having a crown of 5 or 6 apparently jointed terminal joints. The marginal teeth of the labium are rounded, of equal size and five in number; those of the hypopharynx are minute, rounded and also of equal size (fig.6, h). The body has a very few scattered minute setae. Caudal appendages as shown in pl.19, fig.10. The claws of the posterior legs are very slender, and the slender, central ones apparently without a basal prominence. Anterior claws quite numerous and slender, not pectinate.

Pupa. Yellowish; length 4 mm. Respiratory trumpet cucumber shaped with basal end somewhat curved and tapering (pl.20, fig.7); near the base of each is an arcuate transverse line of short, pale, blunt tubercles. Abdominal segments nearly devoid of setae. The caudal fin (pl.20, fig.8) consists of two pointed

processes, each with a pair of pale, slender filaments, and on the lateral margin of each of the last two segments are four or five of such filaments.

Imago. Male and female. Pale yellow, wings marked, legs pale yellow. Length 3 to 5 mm.

Male. Head pale yellow, including basal joint of the antenna. Antennae yellowish brown, eyes black, palpi and apex of the proboscis fuscous. Thorax pale yellow with three wide buff-colored stripes; or it may be said that the dorsum of the thorax is buff-colored, having three fine whitish lines, upon each of which there is a close row of pale hairs. In some lights the anterior part of the thorax, a space in front of the scutellum and the scutellum have a whitish sheen. Pleura, metanotum and sternum are yellow or buff-colored, the first has 3 brownish bars or spots; the last has its sides brownish. The abdomen is pale yellow; near the anterior margin of each segment is a transverse row of brown spots; these are sometimes confluent and thus form bands; the last two or three segments are more brownish. Genitalia conspicuous, pale yellow. The hairs on abdomen and genitalia pale. Legs, including coxae, cream-white, the hairs pale, apex of each tibia with a very minute black comb with one tooth prolonged into a spur. Fore metatarsus more than three-fourths as long as its tibia. Wings hairy; a brown cloud covering the crossveins, a larger paler cloud at the tip of R_1 extending nearly across the wing, but very faintly beyond the media; a third faint cloud at the apex of Cu_2 extending to the media; a fourth very faint one in the anal cell. Veins pale, except the crossveins which appear dark. Some of the spots on the wing in some specimens coalesce so their wings may be said to have two cross bands. Halteres white.

Female. Differs from the male in having pale yellow antennae; palpi sometimes pale, abdomen yellow, the posterior margin of the segments with a whitish sheen. The wings are broader.

Var. a. female. Differs from the above in having the anterior end of all three dorsal stripes tipped with dark brown, and two small dark brown spots on the middle of the median stripe. Metanotum with a white central line, pleura with three brown dashes, two vertical and one horizontal. Several specimens. Ithaca N. Y.

Var. b. female. Differs from a typical specimen in having a deeper yellow thorax, brownish stripes, yellowish brown metathorax, pleura and sternum yellowish brown or brownish. Abdominal segments with indistinct yellowish posterior margins. Legs yellow, last two tarsal joints infuscated. Several specimens. Ithaca N. Y.

Var. c. male. Yellowish brown; length 2 to 2.5 mm. Thorax, including pleura, sternum, and metanotum reddish brown, scutellum and humeri yellow, dorsum of thorax with three indistinct longitudinal stripes darker brown. By oblique light it appears as if there were four dark brown stripes and five narrow whitish ones. Abdomen yellowish white, with the anterior margin of each segment blackish, this color produced backward on the dorsal and ventral surface in a fine line, forming broken longitudinal stripes. Posterior segments and the genitalia more brownish.

Female like the male, but the abdomen is brown, with slightly paler posterior margins. Ithaca N. Y.

5. Ablabesmyia pulcripennis Lundbeck

1898 Tanypus Lundb. Vidensk. Meddel. p.293

(Pl.37, fig.17)

Male. Thorax cinereous black, with three wide black stripes, the median one posteriorly, the two lateral ones anteriorly abbreviated, the former divided by a fine longitudinal line, the intermediate space and the lateral margin of the dorsum with erect black pile; scutellum and metathorax black, the sternum and the sides of the thorax cinereous. Abdomen slender, black, with dense brown pile, the claspers quite large, shining, pilose. Antennae brownish. Legs brown or dusky, tibiae and tarsi white annulate. Halteres yellow. Wings densely clothed with hairs, and therefore cloudy; at the costal margin yellowish tinged, the costal veins pale brown, the others not colored. The venation as shown on pl.37, fig.17. The legs have long pile, the fore metatarsus is one-third shorter than the tibia.

Female. The female is shorter and stouter than the male, the legs are a little paler, the femora yellow, with the tips blackish brown. Legs all with shorter and less dense pile, the antennae brown, shorter than the thorax, in other respects like the male. Greenland. Translation.

6. Ablabesmyia monilis Linne

1758 Tipula Linn. Syst. Nat. ed. X. p.587
1767 Tipula Linn. Syst. Nat. ed. XII. 2:975
1804 Chironomus Meigen. Klass. 1:19, 24
1818 Tanypus Meigen. Syst. Beschr. 1:60
1850 Tanypus Meig. Zett. Dipt. Scand. 9:3613
1864 Tanypus Meig. Schiner. Fauna Austr. 2:620
1877 Tanypus Meig. Wulp. Dipt. Neerl. 1:302
1776 Tipula maculatus Degeer. Mem. l'hist. Ins. 6:394
1823 Tanypus annulatus Say. Jour. Acad. Nat. Sc. Phil. 3:15

(Pl.19, figs. 11, 12, 13, 14, 15, and pl.27, fig.6)

Larva. The larvae were found in Ithaca and Saranac Inn, N. Y. They are yellow with brown markings; length 6-7 mm. Head brown, about twice as long as wide; antennae slender, 2.5 times as long as the mandibles, the basal joint about six-sevenths of the whole length. Mandible slender (fig.14 md) the apex black and sharp, the two lateral teeth short and sharp. Maxilla (mx) large with a mesad projecting process; its palpus (p) jointed, about one-half as long as the mandible, with a pair of apical papillae. Labium (l) with five black teeth, the laterals larger and longer than the median; hypopharynx (h) with a toothed margin, excepting its middle section (covered by the labium) which connects the lateral parts. The anterior claws are numerous, slender, curved at the tip but not pectinate. The abdomen is glabrous. The posterior appendages resemble those shown in fig.10, having elongate dorsal papillae each with about six apical setae. The claws of the anal prolegs differ from those of allied species in having two on each foot stouter, and much darker colored (fig.12) than the others (fig.11). Besides the stout dark ones there are the usual number of paler, stout marginals, and slender centrals.

Pupa. Dark yellow, mottled; length 3.5 to 4 mm. Respiratory organs ellipsoidal, dark colored (fig.13), smooth surfaced, the polygonal areas of the chitin distinctly visible. The apical aperture minute. At the base upon the thorax there is a transverse row of small, sharp tubercles. The surface of the abdomen without hairs, excepting the lateral margin of the last two segments, which have four or five long filaments. The caudal fin has two pointed lobes each with a pair of filaments.

Imago. Whitish; antennae of the male with pale brown hairs; of the female still paler; palpi yellowish. Thorax pale ashgray with five narrow longitudinal stripes, with wider intermediate spaces; the fine lines with hairs; scutellum reddish yellow, metanotum brownish black. Abdomen of the male with a more or less distinct interrupted longitudinal stripe, which broadens on the last segments; the claspers whitish, rather short (pl.32, fig.3). In the female the abdomen is wholly dark brown. Legs white, with narrow brown rings, one just before the tip of the femur, three on the tibia, two on the first tarsal joint and one on each of the following joints. In the male the fore tarsi and the hind legs are short haired; the fore metatarsus about one-fourth shorter than the tibia. Halteres white; wings with a whitish tint, hairy, with brown bordered crossveins and many brownish gray spots. R_2 is present, near the tip of R_1; the cubitus forking proximad of the crossvein. Length 3.5 to 4.5 mm.

I can not distinguish the American specimens from those which I have from Europe. The marks upon the abdomen of the male are quite variable; in some specimens they are simply spots on the posterior lateral margins of the segments, in others they form a broken median dorsal stripe, and in still others they are almost entirely wanting. The male genitalia in some specimens are somewhat brownish. The dark spots upon the wing are arranged as follows: One on the humeral crossvein, one on the discal crossveins, one at the tip of R_1, and one at the tip of R_{4+5}. The paler spots are larger than the darker ones. There is one below the tip of R_{4+5}, one in the middle of cell R_{4+5}, a small one at the tip of the median, and one at the tip of each branch of the cubitus, one or two in the median cell and several in the anal cell. The fork of the cubitus is also clouded. Some of these spots are not always distinct because the color is due to the darker colored hairs, which are easily rubbed off. The wing of the female is usually darker than that of the male. (Pl.27, fig.6.) Specimens from New Jersey, Illinois, Ithaca, N. Y., South Dakota.

Osten Sacken, in a note in his catalogue of the North American Diptera (1878), first calls attention to the fact that T. annulatus Say and monolis Linn. may be synonymous. I have compared the North American species, which agree perfectly with Say's description, with specimens of monilis from Europe, and I can find no differences. For the sake of comparison, Say's description is given below.

Tanypus annulatus Say

Jour. Ac. Nat. Sc. Phil. 3:15. 1823

Tergum annulate with dusky; wings clouded with dusky and with three or four blackish points. Inhabits Pennsylvania.

Head and stethidium red-brown; thorax, the anterior dilated line with a brown line along its middle; feet white, thighs having an annulus near the tip, and tibia with one at base and two near the tip fuscous; wings with large, obsolete, dusky, spots or clouds, and three or four black-brown points, of which two are toward the middle of the wing, and the remainder on the costal margin near the tip; tergum segments with a dusky annulus at their bases. Length about 3/20 in. Male.

7. Ablabesmyia venusta Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:91

(Pl.27, fig.8)

Male. Head black, mouth parts brown, antennae pale yellow, middle of joints of basal half and whole of the apical joint brown, the hairs brown and yellowish; thorax black, opaque, mottled with grayish pruinose spots and lines; scutellum yellowish, its narrow base, stripe in middle, and nearly whole of under side dark brown; abdomen whitish, an interrupted band on the hind end of the first five segments and nearly the whole of the following segments brown; legs yellow, two bands near apex of each femur, one near base of each tibia, also apices of tibiae and of joints of tarsi brown; wings covered with hairs, hyaline, marked with about 11 brown spots located at extreme base of wing, on humeral crossvein, before middle of axillary cell, beyond middle of anal cell, on the central crossveins, near middle of cell R_{4+5} near apex of this cell, beyond middle of cell M and of cell Cu, and at the apices of the vein R_1 and of R_3; R_1 near its apex connected with R_3 by R_2; cubitus forks slightly before the crossvein. Length 4 mm. Los Vegas Hot Springs, N. M.

Four male specimens from Leland Stanford jr. University, California, agree with the description given by Mr. Coquillett, excepting that the fasciae at the posterior margins of the abdominal segments are not interrupted, but are produced forward a little at the middle. Upon the ventral surface of each segment in front of the posterior margin there is a black spot. The large basal joint of the antenna and the genitalia are brown. Halteres yellow.

Four female specimens from the same place are like the male, but the antennae are wholly fuscous, and the abdomen is darker, with more yellowish, and the venter is brown. The fore metatarsus is about six tenths as long as its tibia.

8. Ablabesmyia guttularis Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:92

Head and its members dark brown, joints two to four of antennae, apices of the other short ones, and a space before the apex, light yellow, plumosity brown, changing into whitish at the apices; thorax black, opaque, gray pruinose, mesonotum marked with three indistinct dark vittae, the middle one divided by a median black line prolonged to the scutellum, the latter light yellow; the abdomen pale yellowish, first segment with two brown vittae, the others with a black fascia before the middle of each, hairs of

each segment consisting of an anterior whorl and a posterior transverse pair of clusters; legs light yellow, coxae black, a brown band before apex of each femur and another beyond base of each tibia, apices of tibiae and of tarsi brown, front tarsi ciliate with several rather long hairs; wings wholly covered with hairs, whitish hyaline, from base to small crossvein marked with four brown spots, one on humeral crossvein, two in anal cell, and one before apex of basal cell R, passing over the crossvein at apex of basal cell M and reaching the wing margin, where it is greatly extended and rather faint; a brown spot at base of vein R_{4+5}, apex of wing from slightly before the tip of R_1 grayish brown and containing several whitish hyaline drops; R_1 near its tip connected with R_3 by the oblique R_2; halteres whitish; length 5 mm. Two males. Pullman, Washington.

To the above description I may add that the female differs from the male in having the abdominal segments more yellowish, with narrow basal fasciae, and the wing markings are somewhat darker, the anal cell being brown with several hyaline spots; length 4 mm. Five females. Pullman, Washington.

9. Ablabesmyia barberi Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:90

Male. Yellowish white, apices and a broad band at middle of antennae; three vittae on mesonotum; the metanotum, spots on the pleura and sternum, black; mouth parts, a band near bases of segments 2 to 5; the whole of the following segments except their hind borders, also apices of femora, both ends of tibiae, apices of first four joints of tarsi and whole of last one, pale brownish; mesonotum opaque, gray pruinose; hairs of the antennae pale yellowish; wings covered with hairs, hyaline, from the base to the small crossvein marked with three brown spots, one on the humeral crossvein and two behind the anal vein; from small crossvein to wing tip are many, mostly isolated, brown spots; R_1 near its apex connected with R_3 by the oblique R_2; cubitus forks slightly before the crossvein; length 4 mm.

Female. Like the male except that there is no black ring at middle of the antennae, and the abdomen is dark brown, changing into yellow at the apex, the broad hind margins of the segments whitish; length 3 mm. Las Vegas, Hot Springs N. M.

10. Ablabesmyia dyari Coquillett

1902 Tanypus Coq. Ent. News. p.85

(Pl.19, fig.7, and pl.27, fig.9)

The pupa is figured and briefly described by Doctor H. G. Dyar (1902) p.56. He says, "It resembles a Culex pupa,

has the same habits, resting at the surface of the water with the slender funnel-shaped prothoracic air tubes penetrating the surface film and quickly descends when disturbed. The anal paddles resemble those of Culex, but are more hairy."

This species was also bred in a laboratory jar at Ithaca N. Y., the larva having been collected from one of the ponds in the vicinity. The empty larval skin of the single specimen was lost.

Pupa. Fuscous green. Respiratory trumpet (pl.19, fig.7) somewhat elongate, its free end open, the surface rugose. There are no blunt setae near the base. Body nearly devoid of setae, excepting the margin of the last two segments, which have four or five lateral filaments each. The caudal fin consists of two pointed lobes with ciliate margins (pl.19, fig.6).

Imago. Male and female. Yellowish brown, the scutellum, abdomen, halteres and legs pale yellowish, the abdomen changing into yellowish brown toward the apex and with a similarly colored band on the preceding segments except the first, a brownish band before apex of each femur and near the base of each femur and near base of each tibia; antennal plumosity of male brown mixed with whitish and changing into white at the apex; mesonotum opaque, grayish pruinose, the three vittae indistinct, yellowish brown; abdominal segments 2 to 6 bearing near the base a dorsal cluster of rather long brown hairs; front tibiae only pubescent, their tarsi bearing a few rather long hairs, middle and hind tibiae densely covered with such hairs; wings densely haired, hyaline, a median band and the apical third brownish and marked with several hyaline spots; median band very irregular, greatly contracted at the middle and expanded at each end, the median crossvein about at its middle and clouded with darker brown, the hyaline spots principally situated near the hind margin of the wing; brown at apex of wing contains about eight hyaline spots and dots; cubitus forks slightly before the crossvein; length 3 to 4 mm. Washington D. C.; New York; Massachusetts; South Dakota; Pennsylvania, and Michigan.

In an immature specimen the parts of the body described above as yellowish are more or less green. Wing venation as figured on pl.27, fig.9. The fore metatarsus is but little over one-half as long as its tibia.

11. Ablabesmyia johnsoni Coquillett

1901 Tanypus Coq. Proc. U. S. Nat. Mus. 23:609

Male. Yellow, the scutellum, halteres, and tarsi white; apical joint of the latter, a band before apex of each femur and near base of each tibia brown, abdomen whitish, each segment with

an irregular brown mark, composed principally of two median vittae and a posterior arcuate fascia, most distinct on the median segments, on the apical ones expanded so as to cover nearly the entire dorsum; hairs of antennae mixed pale yellow and brown, their apices chiefly whitish, mesonotum opaque, whitish pruinose; in certain lights three dark yellow vittae are visible; front tarsi clothed with very short hairs, the first joint two-thirds as long as the tibia; wings whitish hyaline, almost wholly covered with yellow hairs, humeral crossvein bordered with brown, a broad pale brownish fascia crosses the wing just before the small crossvein, and a second slightly broader one at apex of R_1, cubitus forking a short distance before the small crossvein; length 3.5 mm.

Female. Differs from the male as follows: Abdomen with dark yellow mottlings, destitute of brown markings, hairs of antennae whitish, vittae of mesonotum more distinct; length 3 mm. Riverton N. J.

12. Ablabesmyia ornata Meigen

1838 Tanypus Meig. Syst. Beschr. 14, 7:31
1864 Tanypus Schiner. Fauna Austr. 2:620
1877 Tanypus V. d Wulp. Dipt. Neerl. p.304

Male. Pale yellow; the antenna and its hairs of the male pale brown. Thorax with three deeper yellow stripes; the two lateral ones bounded anteriorly by a fine brown or black line, which is continued over the pleura to the base of the wing; metanotum brownish. Abdomen with slightly darkened incisures; the last segments of the male brownish yellow; claspers yellowish, quite stout. Legs whitish; near the apex of the femur a brownish ring; the tips of the tibiae slightly browned; fore metatarsus a little shorter than the tibia; fore tarsi of the male slightly ciliate. Halteres white. Wings hairy, pale yellow, with two cross bands and a dark spot at the anterior margin a short distance from the tip; the crossveins blackish bordered; the venation as usual. Length 5.5 mm.

Var. a. female. Differs from the above in having the abdomen with mottled dark brown irregular fascia on each segment. The fore metatarsus about three-fourths as long as its tibia.

Var. b. female. Differs from the typical form in having three distinct, opaque, ferruginous thoracic stripes, humeri white, anterior margin of the dorsum narrowly blackened; no blackish pleural spots; metanotum and sides of scutellum ferruginous or brownish. Abdomen brown, segments with paler posterior margins. The brown clouds on the wings so coalesce that the wings may be described as having two wide, irregular cross bands, one before the middle and one between the middle and the tip; crossveins almost black. Several specimens, Ithaca, N. Y.

13. Ablabesmyia algens Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:90

Female. Yellow, three vittae on the mesonotum; the metanotum, spots on the pleura, and the sternum, brownish black; mouth parts, apices of femora, and bases of tibiae brownish; mesonotum grayish pruinose, the vittae somewhat polished; wings covered with hairs, hyaline, crossed at the middle by a faint brownish band which extends from small crossvein half way to the wing tip; R_1 near its apex connected with R_3 by the oblique R_2; cubitus forks slightly before the crossvein; length 3 mm. Popoff Island, Alaska.

14. Ablabesmyia discolor Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:89

Female. Yellowish brown; antennae, scutellum, large portion of abdomen, legs except apices of femora and tibiae, also the halteres, yellow; mesonotum grayish pruinose, most dense at the humeri and in front of scutellum; wings whitish hyaline; two crossbands and the apex largely brown; the first band is on a line with the humeral crossvein, and along costa is broadly connected with the second band, which is located at the small crossvein; behind the cubitus the second band is prolonged to meet the brown at apex of wing; the latter begins a short distance before the apices of R_1 and of Cu_2, and encloses a large hyaline spot in apex of cell M and cell Cu_1, also two yellowish costal spots; the brown along the costa comprises two spots of a darker color than the remainder of the brown at the apex of the wing, and between the first of these spots and the preceding brown band is a large yellow costal spot; wings densely covered with hairs, which are yellowish on the hyaline portions and brown on the dark spots; R_1 connected with R_3 a short distance before its tip by the oblique R_2. Cubitus forks slightly before the crossvein. Length 3 mm. New Hampshire.

15. Ablabesmyia melanops Wied. (Meig.)

1818 Tanypus Meigen. Syst. Beschr. 1:65, 18
1850 Tanypus Zett. Dipt. Scand. 9:3621
1864 Tanypus Schiner. Fauna Austr. 2:621
1877 Tanypus V. d. Wulp. Dipt. Neerl. p.306
1757 Tipula ?arundineti L. Fauna Suec. ed.II. p.434
1818 Tanypus Meig. Syst. Besch. 1:66, 19
1823 Tanypus bicolor Fries. Monogr. Tanyp. Suec. 17, 12

Pale reddish yellow, including the antennae, palpi, legs and halteres; eyes black. Thorax with three reddish longitudinal stripes, the median one divided; the intermediate spaces and the

flattened area in front of scutellum with a whitish sheen. Abdomen of the male whitish; the posterior segments sometimes with reddish longitudinal stripes. The abdomen of the female a pale flesh color. Legs almost white. Fore metatarsus about three fourths the length of its tibia; the fore tarsi of the male and the hind legs hairy. Wings whitish, unspotted, with pale hairs and almost colorless veins; R_2 short, near the tip of R_1 appearing like a crossvein, but difficult to see on account of the hairs; the cubitus forks proximad of the crossvein, the latter being proximad of the middle of the wing. Length 3.5 to 4.5 mm. Specimens from Ithaca, N. Y., Michigan, Nebraska and New Jersey. I can not distinguish the American specimens from those which I have from Europe. The dorsal stripes of the thorax are buff-colored, but they are usually distinct.

Var. b. female. Thoracic stripes reddish. Length 2.5 mm. From Ithaca, N. Y.

16. Ablabesmyia flavifrons n. sp.

Larva. The larvae were found rather abundantly in a small ditch of flowing water. Ithaca, N. Y.

Sordidly white, slightly mottled with brownish; length 9 mm. Head pale brown, about 1.5 times as long as wide; the parts of the head resemble those figured on pl.20, fig.6. The antennae are about 2.5 times as long as the mandible, the basal joint being nearly seven eighths of the whole length. The maxilla is large, the palpus prominent but shorter and stouter than that shown in the above-mentioned figure (compare figs. 1 and 14). The labrum, hypopharynx, and the feet are like those of monilis (pl.19, fig.14), but all the claws of the posterior feet are of the same color.

Pupa. The only essential difference between this pupa and that of monilis (pl.19, fig.8) is the absence of the row of tubercles at the base of the breathing trumpet and the form of the trumpet. The latter is rather small, about two thirds as long as the third abdominal segment, enlarged at the apical end (pl.19, fig.2).

Imago, male. Yellowish white and brown. Abdomen fasciate. Legs pale. Length 3.5 to 4.5 mm.

Head yellow, palpi and tip of proboscis subfuscous; basal joint of the antenna dusky, flagellum brown with brown hairs. second antennal joint yellow. Pleura, scutellum and dorsum of thorax pale yellow, the last with three broad, dull brown stripes, the middle one divided; sternum and metanotum blackish. Abdomen pale yellow, the anterior third or half of each segment brown; genitalia and venter pale yellow. Legs yellowish, tarsi some-

times slightly darker, extreme tip of each tibia with black speck; fourth tarsal joint linear; fore metatarsus about three fourths as long as its tibia; fore tarsi and middle and hind legs with rather long hairs. Wings hyaline, pale yellow haired, crossvein not clouded; R_2 present near the tip of R_1, cubitus forking slightly before the crossvein. (Pl.27, fig.11.) Halteres pale.

Female. Antennae wholly yellow, except fuscous apical joint; abdomen dusky yellow, posterior margins of segments slightly paler.

This species agrees with the description of nigropunctatus Staeger (1839), but the sternum and metanotum are dusky and not yellowish. Several bred specimens Ithaca, N. Y.; Idaho; Pullman, Washington.

17. Ablabesmyia flaveola Williston

1896 Tanypus Will. Trans. Ent. Soc. Lond. p.275

Male. Posterior forked cell not petiolate; wings hairy; front metatarsi nearly as long as their tibiae. Light yellow; antennae brownish, the plumosity gray; abdomen somewhat infuscated towards the tip; legs light yellow throughout, with rather abundant light yellow hair; wings hyaline, clothed moderately densely with gray hair. Length 1.5 to 2 mm. St Vincent Island, West Indies.

18. Ablabesmyia pallens Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:91

Male. Head brown, mouth parts and basal joint of antennae concolorous, remainder of antennae yellow, the hairs brown and whitish; thorax whitish, three vittae on mesonotum, metanotum, spots on the pleura and sternum dark yellow; abdomen pale yellow, a band near base of segments 2 to 5 and nearly the whole of the following segments, pale brownish; legs and halteres whitish; wings hyaline, covered with hairs, R_1 near its apex connected with R_3 by the oblique R_2; cubitus forks slightly before the crossvein; length 2.5 mm.

Female. Abdomen wholly yellow, otherwise as in the male; length, slightly over 1 mm. Las Vegas, Hot Springs, N. M.; New Jersey, (Johnson, '04).

Var. a, (pl.27, fig.14.)

Male. Dorsum of thorax with three wide fuscous stripes, humeri and scutellum yellow, the latter perhaps a little darker. Pleura brown, metanotum and sternum blackish. Palpi and proboscis yellow. Specimens from Ithaca, N. Y.

19. Ablabesmyia indecisa Williston

1896 Tanypus Will. Trans. Ent. Soc. Lond. p.276
(Pl.27, figs. 12 and 13)

Male and female. Wings hairy; posterior forked cell not petiolate; front metatarsi shorter than their tibiae. Head and basal joint of the antennae reddish yellow; palpi and the remainder of the antennae brownish yellow; antennal plumosity of the male gray, towards the tip blackish. Thorax reddish yellow; bare, opaque, with three slender, reddish brown stripes in front, separated by ashy intervals; on each side posteriorly with an elongate brown spot, the middle of which is ashy; scutellum light yellow; metanotum brownish red. Abdomen slender; opaque brown, the posterior angles and borders of the segments ashy; the yellow of the venter sometimes encroaches upon the brown of the dorsum; sixth and seventh segments more distinctly yellow; the seventh and eighth segments with the posterior portion blackish. Legs yellow, less hairy than in A. flaveola. Wings hyaline, moderately hairy. Length 1.5 to 2.25 mm. St Vincent Island.

I have compared my male specimens with the cotype male specimen from the St Vincent collection of Cornell university, and cannot detect any differences.

Var. a. (fig.12). Male and female; agrees with Williston's description, excepting that there are but two reddish brown stripes in front (i. e. the usual middle stripe with a very slender dividing line); and all the abdominal segments are marked alike with ashy borders.

To Williston's description of the normal species the following may be added: The brown of each segment of the abdomen more intense just in front of the ashy posterior margin. The abdomen of the female is reddish brown, the incisures yellow and the margins of the segments ashy. Specimens from Ithaca, N. Y., and Pennsylvania.

20. Ablabesmyia pilosella Loew

1866 Tanypus Loew. Berl. Ent. Zeit. p.5

Female. Testaceous or subfuscous, with pale pile, the dorsum of the thorax without stripes, the scutellum, legs and antennae very pale, the last with long pile and toward the tip blackish, the wings thickly pilose, subcinereous, the basal cells short. Length 1 mm. Wing 1.2 to 1.3 mm.

Small, opaque, testaceous or subfuscous. The antennae ordinary, pale, blackish towards the tip, clothed with very long pile, the last joint not thickened. The dorsum of the thorax without

the usual stripes, sometimes whitish; scuttellum pale. Legs and halteres whitish; wings thickly pilose, subcinereous, the costal margin somewhat yellowish, the basal cells short. Translation. (Loew.) District of Columbia.

Through the kindness of Mr S. Henshaw of Cambridge, Mass., who examined the type for me, I may add that the fork of the cubitus begins before the M-Cu. crossvein; the basal cells are short, one third or less than the wing in length, and the abdomen is brownish.

21. Ablabesmyia tibialis Staeger

1845 Tanypus Staeger. Groenl. Antl. Nat. Tids. 2 den. R. B. I. 354

Blackish; halteres and legs pale fuscous, hind tibiae of the male long pilose; wings grayish, hairy. Length 2.5 mm.

Male. The blackish body is without markings; thorax dark; abdomen is somewhat shining and fuscous haired. The legs are sordidly yellowish brown, sparsely haired; the tibiae, particularly the hind pair, are long-haired. The wings are covered with gray hairs; the vein R_1 runs parallel with the wing margin and ends one third the wing length from the tip, R_{4+5} ends near the tip, the oblique R-M crossvein being near the middle of the wing; the media is slender and ends at the wing tip; the fork of the cubitus lies directly under the R-M crossvein; the M-Cu. crossvein is vertical (its position is not stated by Staeger); the branches of the radius are stout, but the cubitus and the anal veins are nearly invisible.

Lundbeck (1898) p.294 describes the female as follows:

Female. Resembles the male, but the abdomen is shorter and stouter; the wings are wider and the veins are a little stouter; with long pile on the hind tibiae, though not so long as that of the male; in other respects like the male.

Greenland (Staeger and Lundbeck).

22. Ablabesmyia fastuosa n. sp.

(Pl.19, figs. 16–19)

A single larva from Eddy pond, Ithaca, N. Y., in April.

Larva. Reddish, length about 7 mm. Head brown, rather short; about 1½ times as long as wide; antennae more than twice as long as the mandible. The basal joint about two thirds of total length (fig.17). Mandible resembles that of monilis, but with a broader lateral tooth (fig.16). Maxilla prominent with long palpus, hypopharynx and labium like that of monilis; the latter, however, has teeth in the middle shorter than the lateral ones, while the former has the teeth nearly equal in length.

Feet as usual, all claws of the same brownish color. Dorso-anal papillae with six to eight setae. Blood gills as in monilis.

Pupa. Pale fuscous. Length about 4 mm. Breathing trumpet (fig.18) about three times as long as broad, with large apical aperture, its surface spinose scaled. The surface of the abdomen under a very high magnification appears finely punctate. The lateral margin of the last two segments with the usual 4 or 5 filaments. The caudal fin (fig.19) has two pointed lobes, the surface covered with minute spinose scales.

Imago. Female, fuscous, legs and wings unmarked, the latter hairy and with darkened crossvein. Length about 3 mm.

Head, including palpi, proboscis, and antennae fuscous; eyes black. Thorax, including pectus, pleura, scutellum and metanotum fuscous; the dorsum, with the humeri, space in front of scutellum and three fine longitudinal lines more cinereous, in some lights the other parts appear more cinereous. Hairs dusky, abdomen fuscous, posterior margins of the segments cinereous; the hairs pale. The legs pale fuscous; the extreme tips of the tibiae darker. Fore metatarsus 0.6 as long as its tibia. The wings subhyaline, hairy, unmarked, crossveins and the radius darker than the other veins, crossveins specially distinct, R_2 present; cubitus forks a little proximad of the crossvein. Halteres white. Bred specimen. Ithaca. N. Y. Michigan. A specimen from Pullman, Wash., has dorsum of thorax and scutellum yellowish, the three dorsal stripes distinct, dull brownish black.

23. Ablabesmyia hirtipennis Loew.

1866 Tanypus Loew. Berl. Ent. Zeit. (Centur. VII). p.5

Female. Wholly fuscous, wings about the same color, thickly pilose, crossveins black, all of the tarsal joints linear. Length 3.5 to 3.8 mm. Wing 4.1 to 4.2 mm.

Fuscous; antennae, the posterior margin of each of the abdominal segments and the femora, excepting the tip, rather paler, palpi darker; the tarsi long in proportion, dark fuscous toward the tip, all its joints linear, decreasing in length, the last one shorter than the one preceding. Wings cinereous fuscous, thickly covered with long fuscous pile, the veins as is usual with the species of this genus, the crossveins black, the others subfuscous, R_{4+5} running into the margin of the wing near its tip. Translation. Maine.

Mr. S. Henshaw of Cambridge, Mass., who kindly examined the type for me, writes that the fork of the cubitus begins proximad of the crossvein, the halteres are luteous, and the thorax is striped.

24. Ablabesmyia nigropunctata Staeger.

1839 Tanypus Staeger. Kröjer; Nat. Tidsskr. 2:589, 16
1850 Tanypus Zett. Dipt. Scand. 9:3624
1864 Tanypus Schiner. Fauna Austr. 2:621

Male and female. Whitish; antennae pale; eyes black. Thorax in dried specimens yellow, in life with a reddish tinge; dorsal stripes pale; sternum and metathorax yellow; scutellum white. Abdomen whitish, slender in the male, pilose, the last three segments a little wider, each segment with a brown, basal transverse fascia on dorsal surface, venter spotless; anal appendages white. Abdomen of the female stouter, pubescent, spotless. Wings white, spotless; halteres white. Legs white; fore metatarsus about one fourth shorter than its tibia. Fore legs of the male without long hairs. Pullman, Washington.

25. Ablabesmyia (?) sp.

A larva from Beebe lake, Ithaca, N. Y., is yellow; 5 or 6 mm. long; resembles P. adumbratus in having a short head, comparatively short antennae and in shape of the mandible; but differs in having but four marginal teeth in the labium (pl.19, fig.5) and in having rather more slender marginal claws in the posterior feet.

Genus 18. Isoplastus Skuse.

Proc. Linn. Soc. N. S. W. p.279. 1889

Antennae in the male 15-jointed, in the female 12-jointed. Wings pubescent. Marginal crossvein (R_2) and second longitudinal vein (R_3) pale and indistinct. Fork of the cubitus with its base at base of M-Cu. crossvein.

This genus was erected to contain several Australian species. It may later be found that this genus can not be separated from Ablabesmyia in which case the name Isoplastus has precedence.

Genus 19. Tanypus Meigen.

Illiger's Magaz. (part.) p.261. 1803

One of the subdivisions of the old genus Tanypus of Meigen. Wings hairy; cubitus forks distad of the M-Cu. crossvein, and is therefore petiolate.

Skuse (1889) gives the name Tanypus to the group having hairy wings and the fork of the cubitus sessile; but since Meigen gave the species cinctus (=punctipennis) as the representative of the genus, and since it possesses a petiolate cubitus,

it appears to me that the name should be retained for species having this character.

KEY TO SPECIES OF TANYPUS

Imagines

a Wings clouded (banded or spotted)

b Legs nearly uniform in color; wings uniformly spotted with fuscous; thorax with three dusky stripes; legs yellow; length 4.5 mm.; female .....Ablabesmyia pictipennis

bb Legs distinctly bicolored. Femora brownish with white subapical rings; abdomen blackish (New York and Texas)....1. stellatus

aa Wings not clouded, excepting sometimes the crossveins or a faint smokiness near apical end; dusky species

b Halteres pale fuscous; blackish species; legs sordidly yellowish brown; wings grayish, hairy; tibia long-haired; thorax dark; abdomen somewhat shining and fuscous haired; anterior crossvein in the middle of wing; length 2.5 mm. (Greenland)

21. Ablabesmyia tibialis

bb Not as above

c Scutellum black; legs usually brownish or black

d Apical half of wing smoky; abdomen brown..4. culiciformis

dd Apical half of wing not smoky

e Thorax gray with black stripes; abdomen cinereous black; M–Cu crossvein far proximad of the fork of the cubitus; halteres sordidly yellow; fore metatarsus but little more than half as long as the tibia; length 2 to 3.25 mm.

2. posticalis

ee Thorax with lateral ferruginous stripes; crossveins clouded; fore metatarsus about three fourths as long as its tibia; length 4 mm.....3. crassinervis

cc Scutellum yellowish; legs usually paler brown or yellow

d Apical half of wing distinctly smoky, especially near the anterior margin; abdomen dark brown; length 3.5 to 4.5 mm. (New York) .....4. culiciformis

dd Wing nearly hyaline; abdomen with whitish incisures

5. choreus

The species pictipennis and tibialis Staeger have been included in the foregoing as well as in the key for Ablabesmyia because there is some doubt as to the position of the M-Cu. crossvein. They are, however, described with Ablabesmyia.

Tanypus tibialis Say (6) and Tanypus baltimoreus Macq. (7) are not sufficiently described to place in the keys; both of these descriptions are reproduced in the body of this work. Tanypus annulatus is a synonym of A. monilis, and T. decedens Walker is perhaps the same as pictipennis Zett.

1. Tanypus stellatus Coquillett

1902 Tanypus Coq. Proc. U. S. Nat. Mus. 25:89

Yellowish brown, antennae except the basal joint pale yellow, abdomen blackish, a whitish ring at three fourths the length of each femur, tibiae except each end, and tarsi except apices of the joints, light yellow, halteres light yellow; mesonotum thinly grey pruinose; wings covered with brown hairs, whitish hyaline, marked over nearly the entire surface with many brown spots, several of which are confluent and enclose small whitish spots; costal cell except at its apex brown; R_1 near its apex connected with R_3 by the oblique R_2, cubitus forks a short distance beyond the crossvein; length 2 mm. Female. Texas, Kansas, New York.

Some male and female specimens captured in Ithaca, N. Y., I have identified as this species. The females agree very well with the description given by Mr Coquillett; the descriptions of the specimens are as follows:

Male. Head, palpi and basal joint of antenna fuscous, the antenna and its hairs a trifle paler. Dorsum of thorax with three dull dark-brown stripes, the middle one divided; the fine lines separating the dark dorsal lines, the lines separating the dark humeral spots from the lateral lines, the anterior margin, and the posterior margin of the middle line, cinereous white. The two minute tubercles of the collar sometimes pale. Metanotum, pleura and sternum, dark brown; scutellum a little paler. Hairs pale. Abdomen dull brown, the posterior margins of the segments whitish. Claspers short, stout, and dark brown. Coxae brown, each femur brown, with a white ring not far from the apex, each tibia yellow with brown base and tip, tarsi yellow, joints black at tip, last joint darker; fourth tarsal joint slender, and longer than the fifth. Wings with many brown spots, that upon the crossveins most conspicuous. Two near the tip of R_1, one on the humeral crossvein, one dark one on the median crossveins, four in cell R_{4+5}, each divided longitudinally by a wing fold; two or three in the cell M; one or two between branches of the cubitus; and several in the anal cell. Venation as shown. Halteres sordidly yellow, the knobs somewhat infuscated, their tips paler. Length 3 mm.

Female. (Pl.27, fig.7.) Like the male, but the abdomen is usually wholly brown, occasionally the margins of the segments very narrowly whitish. Tibiae excepting the knees sometimes brown. Length 2 mm.

2. Tanypus posticalis Lundbeck

1898 Tanypus Lund. Vidensk. Meddel. p.295

Thorax black, shining, with two longitudinal cinereous stripes; or it may be described as having three wide black stripes, shining,

the median one posteriorly, the lateral ones anteriorly abbreviated, and the median one is divided by a fine line; the intermediate space and the lateral margins have some erect yellow pile; scutellum and metanotum black; abdomen slender, cinereous black, with long yellow pile, claspers quite large, pilose. Antennae blackish brown; legs more or less dilutely brown. Halteres sordidly yellow. Wings hyaline, distinctly but not densely hairy, the costal vein brown, the others pale, the cubitus forks far distad of the M-Cu. crossvein (pl.37, fig.20). The second and third pairs of legs with long pile, the first pair bristly, the fore metatarsus a little more than half the length of its tibia. Male. Length 2 to 3.25 mm.

The female is shorter than the male, stouter, the antennae shorter than the thorax; in other respects like the male. North Greenland.

3. Tanypus crassinervis Zetterstedt

1838 Tanypus Zett. Ins. Lappon. 817. 1
1845 Tanypus Zett. Staeger. Nat. Tids. p.354
1850 Tanypus Zett. Dipt. Scand. 9:3599
1898 Tanypus Zett. Lundbeck. Vid. Med. p.294

Black, opaque, halteres whitish, lateral margin of the thorax ferruginous, antennae brown, wings white, somewhat hairy, anterior veins conspicuous, crossvein infuscate, R_2 present, the fork of the cubitus petiolate; legs blackish or fuscous, fore tarsi bare, metatarsus about one fourth shorter than the tibia. Length about 4 mm.

Male and female. Resembles P. nervosus (an European species) but is a little smaller, the body opaque, not shining, the wings with pale hairs, and the legs unicolored. Head black; antennae dark, the hairs (in the male) brownish; palpi dark, thorax black, lightly cinereous shining, dorsum of the thorax in the male with a lateral ferruginous stripe, the humeral spots sometimes more distinct; in the female often reddish yellow, with three wide black stripes, the lateral ones abbreviated anteriorly. Scutellum and metanotum black. Abdomen black, in the male pilose, genitalia small, ovate; abdomen of the female pubescent. Wings white, slightly hairy, anterior veins distinctly fuscous, crossveins more deeply infuscated, the posterior veins distinct but paler. Venation as in P. nervosus (pl.37, fig.24). Legs formed as in the latter, sometimes brown, sometimes fuscous testaceous. An European species, also recorded from Greenland by Staeger (1845) and Lundbeck (1898).

4. Tanypus culiciformis Linne

1767 Tipula Linn. Syst. Nat. ed. XII. 2:978
1805 Chironomus Fabr. Syst. Antl. 47, 44

1818 Tanypus Meig. Syst. Beschr. 1:63, 13
1850 Tanypus Zett. Dipt. Scand. 9:3610, 17
1864 Tanypus Schin. Fauna Austr. 2:617
1877 Tanypus V. d. Wulp. Dipt. Neerl. 299, 4
1826 Tanypus fasciatus Macq. Rec. Soc. Sc. Agri. Lille. 187, 5
1838 Tanypus tenuis Meig. Syst. Beschr. 7:15, 34

Male. Head dark brown, including mouth parts and antennae. Dorsum of the thorax with three dark brown stripes, the middle one divided by a fine line. Humeri and scutellum yellowish brown, sternum and metanotum and sometimes scutellum also, blackish; the pleura a little paler. Abdomen dark brown, the posterior margins of the segments paler, more yellowish; hairs brown. Genitalia short and robust (pl.32, fig.2). Legs yellowish or brownish; the tips of the femora, tibiae, and all the tarsal joints darker. The metatarsus usually yellowish. Fourth tarsal joint linear and longer than the fifth; the fore metatarsus about one fourth shorter than the tibia; the fore tarsi and the posterior legs somewhat hairy, wings hairy, hyaline, the apical half smoky, especially near the anterior margin; crossveins dark clouded, R_1 with R_2 near its tip, the petiole of the cubitus about one half as long as the fork (pl.27, fig.15). Halteres white.

Female. Antennae except apical joint yellowish; the humeri paler and the legs less hairy than in the male. Length 3.5–4.5 mm.

A number of specimens from Ithaca, N. Y., one from Riverton, N. J., one from Idaho, and one from Chicago, Ill., I cannot distinguish from European specimens.

5. Tanypus choreus Meigen

1804 Tanypus Meigen. Klass. 1:23, 6
1818 Tanypus Meigen. Syst. Beschr. 1:62, 12
1839 Tanypus choreus Meig. Staeger. Nat. Tids. 2:585, 7
1850 Tanypus Meig. Zett. Dipt. Scand. 9:3609, 15
1864 Tanypus Meig. Schin. Fauna Austr. 2:617
1877 Tanypus Meig. V. d. Wulp. Dipt. Neerl. 299, 5
1804 Tanypus fasciatus Meig. Klass. 1:21, 3
1804 Tanypus sylvaticus Meig. Klass. 1:24, 9

Antennae brown, including the antennal hairs of the male; palpi more or less brown. Thorax brown, with three darker longitudinal stripes, the spaces between the longitudinal stripes and the flattened area in front of the scutellum whitish; sternum greyish; scutellum yellow; metanotum black. Abdomen brown-black with whitish incisures; venter yellow anteriorly; the anal segment of the male broad and flattened, the claspers short, yellow basally, blackened toward the tip. Legs yellowish brown; the tips of the femora and of the tibiae and the whole of the last four tarsal joints brown; the first joint of the fore tarsus is

one fourth shorter than the tibia; fore tarsi of the male bearded. Halteres whitish. Wings slightly hairy, hyaline, slightly smoky near the tip; the crossvein brown clouded; the cubitus forking distad of the crossvein; venation resembling that of P. nervosus (pl.37, fig.24).

The female is usually somewhat lighter colored. Length 3.5 to 4.5 mm. Translation from V.d. Wulp (1877). "Coloring somewhat variable." Schiner (1864). North America (Osten Sacken, 1878).

6. Tanypus tibialis Say.

1823 Tanypus Say. Journ. Ac. Nat. Sc. Philad. 3:15, 2
1828 Tanypus Wied. Ausser. Europ. Zw. Ins. 1:20, 4
1878 Tanypus Ost. Sack. Catl. Dipt. N. A. p.22

Thorax reddish brown; tibia white at base; abdomen white, a double band on the middle and tip black. Habitat: Pennsylvania.

Wings immaculate; poisers white; feet fuscous, basal half of the tibia white; tergum, second joint with a spot each side, two middle segments with each a band, of which the anterior one is much broader, and terminal segments deep fuscous, pleura yellowish. Length of male more than 1/20 in.

7. Tanypus baltimoreus Macquart

1855 Ternipus Macq. Dipt. Exot. Suppl. V. 15, 1
1878 Tanypus Ost. Sack. Catl. Dipt. N. A. p.21

Female. Palpi tawny, shining cinereous. Antennae wanting. Thorax with wide black bands; abdomen black, posterior margins of the segments white. Legs tawny; tarsi dusky. Halteres brown. Wings greyish, with an oblique black line; veins normal. Length 3.5 mm. From Baltimore. Translation.

Judging from the description this species seems to resemble T. culiciformis, but it has brown halteres. Nothing is said either about the wing venation with respect to fork of the cubitus, whether sessile or petiolate; or whether the wing is hairy or bare; it is therefore impossible to say to which one of the four genera of the group Tanypus it belongs.

Genus 20. Pentaneura Philippi

Verh. z. b. Ges. 35. 629. 1865

The antennae equal in length to the head and thorax taken together, moniliform, 12-14 jointed, verticillate with long hairs, the joints subglobose, not petiolate, the last joint elongate. Palpi elongate, equaling the antennae, joints subcylindrical. Wings

narrow, very hairy, venation as shown on pl.37, fig.16. Legs hairy, elongate, especially the tarsi; first tarsal joint equal to the two following in length; fourth and fifth together equal to the third. Type, P. grisea Ph. Chile. No North American species.

Genus 21. Podonomus Philippi

Verh. z. b. Ges. 7. 601. 1865

Thorax strongly produced over the head. Antennae of the female short, subcylindrical, verticillate with long hairs, eight (?) jointed, the last joint equal to the two or three preceding (pl.37, fig.10). Venation as shown on pl.37, fig.11. Legs elongate, equal, tarsi elongate, the metatarsus about the same length as the tibia, the second about one half as long as the first, the remaining ones short and of equal length. Type, P. stigmaticus. Chile.

From the wing venation it appears that this genus is related to the group Tanypus. No North American species.

Genus 22. Heptagyia Philippi

Verh. z. b. Ges. 41. 635. 1865. (Pl.37, figs. 21, 22, 23)

Head small. Antennae short, 7-jointed, cylindrical, first joint large and thick, the following subequal, the last one oblong, equaling the two preceding ones taken together. Ocelli none. Palpi long, 6-jointed, almost exceeding the antennae, first three joints subcylindrical and equal, the fourth and fifth shorter and subglobose, the last one slender, oblong, equalling the fifth one in length. Thorax very much swollen, with a deep suture near and parallel to the anterior margin. Wing venation as shown in fig.21. Legs elongate, slender, anterior femora not thickened, not armed, anterior tibiae with unarmed extremities, posterior tibiae with minute apical spines; tarsi elongate, first joint nearly equalling the remaining ones in length. Type, T. annulipes Ph. Chile. No North American species.

Genus 23. Corynocera Zetterstedt

Insecta lapponica 856. 1838

Head moderately large, transverse; antennae porrect, shorter than the thorax, arcuate, cylindrical, about 12-jointed; the first joint short, thick, bare, the following 10 very small, rounded, closely sessile, delicately haired, the 12th elongate, conical, wider,

bare; palpi slightly projecting, bent, proboscis short; eyes round, somewhat prominent, remote; front wide; ocelli wanting; dorsum of thorax elongate, arched, higher than the head, no transverse suture, somewhat depressed in front of the scutellum; scutellum small. Abdomen 7 or 8 jointed. Legs short, robust, of unequal length, wholly bare and unarmed; coxae not elongate; halteres short. Wings as long as the abdomen, club-shaped, rather narrow, bare, with 4 or 5 discal veins diverging apically, all very indistinct; on the anterior margin at the apex is a long somewhat curved seta; the posterior margin is not ciliate. The wings of the female are shorter than the abdomen, the genitalia of the male clubbed, legs more robust; the abdomen of the female pointed, with two short appendages. Metamorphosis and life history unknown. Translation from Schiner p.641 (1864).

The only species of this genus is C. crassipes Zett. (=ambigua Zett.), a small, brownish black fly, with pale legs, whitish wings and halteres. Length 2 to 2.25 mm. Lapland and Germany (Beuthin).

Genus 24. Spaniotoma Philippi

Verh. z. b. Ges. 35. 629. 1865. (Pl.37, figs. 13 and 14)

Thorax prominent above the head. Antennae short, scarcely exceeding the palpi in length, 6-jointed, the joints oval, sparsely verticillate with short hairs, the last joint rather acute. Palpi 4-jointed, the first joint thickened, the last one slender, elongate, divided (?).

The wing venation (fig.13) resembles that of Chironomus (sens. lat.) though the crossvein is rather nearer to the base of the wing than in the typical Chironomus. The description does not state whether the wing is hairy or bare. The figure given by Philippi shows the fore metatarsus shorter than its tibia. The genus may possibly be synonymous with either Metriocnemus or Orthocladius.

Type S. bivittata Philippi, Chile. No North American species.

Genus 25. Corynoneura Winnertz

Stettin. Ent. Zeitg. 7:12. 1846. (Pl.36, fig.7, and pl.32, fig.4)

Small species, distinguished by the absence of the anal angle of the wing. Head round, proboscis short, palpi incurved, four-

jointed, the last joint elongated. Antennae of the male 10-jointed, the first joint thick and disk-like, the following eight egg-shaped, the last one thicker and longer than the others, all with long hairs, the last one verticillate; antennae of the female 6-jointed, the first one thick and disk-like, the following four ellipsoidal, the last one somewhat elongate, all with short hairs. Eyes round, ocelli wanting. Mesothorax greatly arched, prolonged over the head, without transverse suture; scutellum small; metathorax much arched. The 8-jointed abdomen is narrow and long. Legs elongated; slender; the posterior pair of tibiae somewhat thickened, spurred; metatarsi elongated; claws and pulvilli very small. Wings in outline club-shaped, bare, and bent down; anal angle wanting; anterior margin thickened. Halteres free; venation as shown on pl.36, fig.7. Genitalia of male shown on pl.32, fig.4 (after Kieffer). Antennae of male 11-jointed according to Kieffer (1899).

Of the larvae and pupae of the members of this genus, but one species has been described as far as I am aware; i. e. Coryneoneura lemnae Frauenfeld (1866). (Pl.36, figs. 1 to 5.) He describes the larvae as filiform, thickened anteriorly, white, with distinct incisures (fig.1). The chitinous pale brown head is oval, with two black eye spots. The antennae 3-jointed 1.5 times as long as the head. The first thoracic segment is in the form of a truncated cone, upon the ventral side of which is a cephalad projecting process, with a bilobed extremity, each lobe possessing a crown of delicate setae. The next thoracic segment largest, with two oval, stigma-like spots on each side. The following 8 gradually decreasing in size; the last is nearly cylindrical, and has upon the dorsal surface a prominence upon which there are several upright setae. There are two anal blood gills and two prominent anal prolegs, at the extremity of each of the latter there is a circle of curved setae. Length 3.7 mm.

The pupa is described as being smooth and pale yellow in color; the wing sheaths being one third of the entire length. The abdominal segments are distinct; the anal end is blunt, upon each side with a hyaline crescent-shaped disk, each with 8 long setae upon its margin (fig. 4 and 5). Length 1.2 mm. The imago resembles C. scutellata Winn. (an European species).

1. Corynoneura atra Winnertz

1852 Corynoneura Winn. Stett. Ent. Zeit. 13, 50, 4
1864 Corynoneura Schiner. Fauna Austr. 2:594

Male. Dorsum of thorax velvet-black; pleura sordidly yellow. Abdomen dark brown. Head black; antennae brown, with brown, shimmering whitish hairs; palpi yellow; legs whitish with dark articulations, last three joints of the hind legs brown. Wings shimmering milky white. Length .8 mm. Europe and Greenland according to Lundbeck (1898).

The male genitalia is shown on pl.32, fig.4 (after Kieffer).

2. Corynoneura celeripes Winnertz

1852 Corynoneura Winn. Stett. Ent. Zeit. 13, 50, 3
1864 Corynoneura Schiner. Fn. Austr. 2:594

Female. Yellow; dorsum of thorax with three broad black longitudinal stripes, the laterals anteriorly abbreviated; pleura and metanotum blackish brown or black. Abdomen black with delicate, whitish incisures; venter sordidly yellow, blackened apically. Head black; palpi and antennae yellow, the apical joint of the latter brown. Legs whitish, with dark articulations, the last three joints of the hind tarsi blackish brown. Wings shimmering whitish. Length 0.8 mm. Europe and Greenland according to Lundbeck (1898). This species is supposed to be the female of C. atra. See Lundbeck (1898) and Kieffer (1902).

A single female specimen reared from a larva found in pond water (Ithaca, N. Y.) agrees with the above description, excepting that the pleura are yellowish.

Genus 26. Wulpiella Kieffer

Bul. Soc. Ent. France. p.66. 1899

Small species having 4-jointed palpi; antennae of female 6-jointed, the 4 intermediate joints verticillate with very long hairs. Tarsal claws simple; metatarsus shorter than its tibia. Wings hairy, the venation as in Chironomus (pl.34, fig.20). The type is W. scirpi Kieffer, an European species. No North American species.

In a note on p.824 of Ann. Soc. Ent. France (1900) the author states that in the figure given by him the crossvein has by mistake been omitted.

The larva is yellowish white, with dark head; length 4 mm. It has black eyes at the anterior angles of the head; a pair of short three-jointed antennae, mandibles four or five toothed, and a

seven to nine toothed labium. Thoracic and anal prolegs present, the latter with prominent retractile claws (fig.22). The caudal papillae are cylindrical, pointed apically, each with three short and three long setae. (Plate 34, figs. 21, 22, 23.)

Genus 27. Limnophyes Eaton

Ent. Monthly Mag. 60. 12. 1875. (Pl.37, figs. 1, 2, 3, 4)

Imago. Head small, ovately triangular; eyes roundly oval, hardly reniform; ocelli absent; antennae divergently porrect, filiform, 6-jointed, with sparse verticils of spreading hairs (fig.3), the basal joint very stout, the second much smaller than the first, but yet slightly thicker than the remaining joints, which are of even width, the apical joint as long as the preceding two together; mouth short, the margin hairy, palpi 4-jointed (fig.2). Thorax robust, above arched anteriorly and produced like a hood over the head (fig.4); its contour viewed from above is somewhat ovate, and it has about four longitudinal rows of short, fine, sparse hairs ascending upwards and inwards; scutellum moderately large, prominent, semicircular or roundly subquadrate. Wings oblong (fig.1), suddenly constricted at the base, rather straight along the costa, the apex almost parabolic, the margins ciliated. The subcostal vein very short, becoming obsolescent in the subcostal area, the radius two-branched, R_1 extending beyond the middle of the costa, the media united by a crossvein to the radius just proximad of the point of furcation; R_{4+5} like R_1, accompanied by a slight crease in the membrane; the cubitus rather deeply forked, the furcation acute, similarly accompanied by a crease which follows its lower branch; this last branch is succeeded by one or two longitudinal folds simulating additional veins (anal veins ?). Halteres large. Legs slender, with fine short hairs; tibiae almost scabrous, with a minute spine at the apex interiorly; the first tarsal joint much longer than the next. Abdomen slender, 8-jointed, with a few hairs above; ovipositor formed of two very short lamellae. Larvae not observed.

In the original diagnosis it was stated that the number of joints in the palpi and abdomen were respectively 5 and 7. It appears to be more correct to regard them as being 4 and 8 jointed. The antennal joints are very likely to vary in number with the sex, and to be more numerous in the male than in the female.

The above description is copied from Verrall's paper in Phil. Trans. p.245, vol.168, only the nomenclature of the wing veins being changed. The figures 1 to 4 on plate 37 are also taken from Verrall, and illustrate details of the species L. pusillus Eaton, a small gnat found at Royal Sound, Kerguelen Island. No North American species.

Genus 28. Chasmatonotus Loew

Berl. Ent. Zeit. p.51. 1864

This genus is related to Hydrobaenus but differs from it in that the palpi are longer, and the flagellum of the antenna is composed of 5 joints in both sexes (i. e. antenna 7-jointed), see pl.31, fig.6. The dorsum of the thorax has a narrow fissure which widens posteriorly in a flat area in front of the scutellum (pl.31, fig.16); hence the name. The wings of our three American species are black with white markings.

KEY TO SPECIES OF CHASMATONOTUS

Imagines

a Wing with two prominent white spots (pl.27, fig.16); the larger near the base of the wing, the smaller subquadrangular, in the fork of the cubitus, a little distad of the middle of the wing (New York, Illinois) 1. bimaculatus

aa Wing not marked in this way

b Wing with a longitudinal vitta between the media and the cubitus; thorax black with front corners, and hind end, and a part of the pleura yellow; abdomen with posterior margins of the segments whitish (Alaska).....2. univittatus

bb Wing with a broad transverse band extending from the radius to the posterior margin (New York).....3. unimaculatus

1. Chasmatonotus bimaculatus Osten Sacken

1877 Chasmatonotus O. S. Bul. U. S. Geol. Surv. 3:191
1878 Chasmatonotus O. S. Catal. Dipt. N. A. p.22

Male. Black; wings of the same color and with two large white spots. Length about 1.5 mm.

Black; thorax shining; base of the abdomen laterally pale greenish yellow; feet black; front coxae and base of all the femora yellowish; the first tarsal joints are of the same pale yellowish color except the tip, which is black. Knob of halteres greenish. Wings black; the first white spot is in the shape of a cross band between the second vein and the anal angle; second spot is square, and situated on the hind margin, within the fork of the cubitus, pl.27, fig.16, pl.31, figs. 6 and 16, pl.32, fig.6.

The first posterior cell and the cell within the fork of the cubitus are much longer than in C. unimaculatus Lw., and the latter cell is longer and broader. Hence it happens that although in both species the cross-band-like spot is placed immediately inside of the proximal end of the fork it occupies the middle of the wing in C. unimaculatus, and is much nearer the base in C. bimaculatus. The abdomen of the male ends in a comparatively large and conspicuous forceps (the "hypopygium maris globosum" in Mr Loew's description of C. maculatus seems to indicate a different structure?). (O. S. loc. cit.)

Catskill mountains and Quebec (Osten Sacken 1877). Several male specimens from Lake Forest, Illinois, received from Professor Needham. New Jersey (Johnson, 1904).

2. Chasmatonotus univittatus Coquillett

1900 Chasmatonotus Coquillett. Proc. Wash. Acad. Sc. 2:395

Male. Black; the bases of antennae, front corners and hind end of thorax, pleura, except the lower portion and one or two spots; halteres, trochanters, and bases of femora and of tibiae, yellow; posterior margins of abdominal segments whitish, mesonotum polished; abdomen subopaque; wings black, the extreme base and a vitta extending from it three quarters the length of the wing, between the medial and cubital veins, white; length 2.5 mm. Sitka, Alaska.

3. Chasmatonotus unimaculatus Loew

1864 Chasmatonotus Loew. Berl. Ent. Zeit. 50
1878 Chasmatonotus Loew. O. S. Cat'l. Dipt. N. A. p.22

Male and female. Black, with black wings, having a whitish spot on posterior margin. Length 2 mm.; wing 2 mm.

Head black, the eyes in both sexes separated by a wide shining front. Proboscis short, black; palpi black, four-jointed; the first joint short, the next two moderate, the second clavate; the third stouter; the fourth linear, a little longer than the preceding. Antennae fuscous black, short, in both sexes alike; the basal joint globose; the five joints of the flagellum short pilose, the first joint cylindrical, the three following short ovate, the last oval. Thorax black, the dorsum shining, the pleura opaque; scutellum the same color. Abdomen black, subopaque, the first segments in the female lurid; hypopygium of the male black, globose. Legs black, the bases of the femora sordidly yellow and the tarsi in immature specimens cinereous. Halteres black. Wings black, with a subtriangular white spot extending from the posterior margin as far as R_{4+5} of the wing. New Hampshire (O. S.)

Genus 29. Telmatogeton Schiner

Verh. zool. bot. ges. Wien. 16-931:1866

The larva and pupa have not been described as far as I am aware, but figures of both are given by Schiner (1868) of an East Indian species T. St. Pauli Schiner. These figures are reproduced on pl.34, figs. 12, 13, 14 and 15.

Imago. Head small and deeply set; the thorax highly arched, robust, rising abruptly behind the head; the abdomen is short and slender; the wings long and of uniform width, extending far beyond the abdomen; the legs are much elongated. Eyes oval, in both sexes widely separated by the deeply excavated front; the ocelli are wanting; palpi 4-jointed, the basal joint small, the following ones of equal length, thickly haired; antennae in both sexes alike, 7-jointed, scarcely as long as the head, the first joint extraordinarily large and thick, the second one slender, the next four disklike, much wider than long, closely joined, the apical joint elongated, somewhat thickened at the base, gradually becoming smaller towards the tip; the basal joint hairy above and below, the others bare. Metathorax strongly developed; the scutellum small; abdomen 7-jointed; male genitalia two-lobed, the lobes closely connected, not spreading or forceps-like; ovipositor of the female pointed; the upper sheath longer than the lower one. Legs long and slender, particularly the hind pair. At the end of each of the tibiae is a pair of short spines, and at the apical end of the metatarsus is a single one; the metatarsus is elongate the second joint scarcely one half as long as the first, the third less than two thirds as long as the second, the next two each half as long as the third; the claws horny, well-developed, furcate at the extreme tip; pulvilli small but well-developed; the empodium large, filling the space between the claws, ciliated at the apical end. Wings long, the anal angle right-angled, the posterior margin nearly parallel with the anterior margin; the subcostal vein running parallel to the costa but not reaching the margin; the cubitus forks proximad of the middle of the wing, its lower branch not quite reaching the margin, anal veins quite short (pl.34, fig.16). Halteres long with a broad knob. The type of the genus is T. St. Pauli Schiner (loc. cit.). A small blackish fly with dusky wings from the Island of St Paul in the Indian Ocean.

One species of this genus has been described from North America T. alaskensis Coq. (1900). The venation of the American species differs slightly from this description. See below.

Telmatogeton alaskensis Coquillett

1900 Telmatogeton Coquillett. Proc. Wash. Acad. Sc. 2:395

Male. Head and its members brownish black, the front velvet black, first joint of antennae velvet brown; antennae about as long as the head, the first joint nearly three times as wide as the others, the latter subcylindrical, the last joint slightly longer than the others and subconical in profile; thorax opaque black, the lateral margins and upper part of pleura varied with yellowish, scutellum, metanotum, and abdomen brownish black, the lateral margins of the latter and hind margins of the ventral segments yellow; coxae mottled black, brown and yellowish, the remainder of legs blackish brown, front femora each bearing a transverse, contiguous pair of blunt tubercles near the tip of the under side, and just beyond them a pair of rather widely separated cavities; front tibiae each bearing a blunt tubercle on the under side near the base, the inner side of each front tibia rather strongly dilated at its first third; first joint of the tarsi nearly three times as long as the second; each of the last three joints slightly over one half as long as the second joint, claws cleft almost to the middle; halteres whitish; wings brownish gray, veins brown, first section of the media yellow, bases of the branches of the radius nearly coalescent; length 4.5 mm. Yakutat, Alaska.

This species agrees very well with Dr Schiner's description and figures except in the structure of the legs, but these are not sufficiently different to warrant the establishing a separate genus for the present form. Coquillett (loc. cit.) Specimens also from Oregon and California. In these specimens the cubitus forks immediately under the crossvein, the latter oblique, the subcosta reaches the wing margin slightly distad of Cu_2. Length 4 to 6 mm.

Genus 30. Macropeza Meigen

Syst. Beschr. 1:87. 1818. (Pl.35, figs. 1, 2, 3)

Small, blackish gray species, with long wings and extraordinarily long legs. Head small; transversely oval; the proboscis and palpi short, antennae 15-jointed; the second basal joint quite large and thick, the other joints peculiarly arranged, the first seven each small at the base and widened toward the end;

the next small, the following ones again, slender and elongate, the last one small; these are all only thinly haired (fig.3). The eyes round, bare, the ocelli wanting (or rudimentary?); front broad. The arching of the thorax gradually becomes greater from the head backward, the transverse suture wanting; scutellum short but wide; metathorax moderately large. Abdomen S-jointed, hypopygium somewhat projecting. Legs long; coxae not elongated, the fore femora shortest, the posterior pair longest; tibiae without spurs; tarsi of the posterior pair of legs extremely slender, and at least as long as the femora and tibiae taken together, the metatarsus about twice as long as the following joints taken together, apical joints small, the sole of the clawed joint bristly, the claws quite long and bent; the halteres prominent. Wings long and narrow; venation as shown in figs. 1 and 2. The first figure is from V. d. Wulp (1877) the second after Meigen (1818). No North American species have been described.

Genus 31. Hydrobaenus Fries

Vetensk. Akad. Handl., 1829. 176. 1830
Psilocerus Ruthe, Isis. XI. 1207. 1831
(Pl.34, figs. 2 to 11)

Fries (1830) describes the larva and pupa at considerable length and gives figures illustrating details of each; the latter are reproduced on pl.34, figs. 2 to 5 and 8.

Larva. The larva is described as being 4 mm. in length, greenish in color, quite slender, and cylindrical. The head (fig.2) is small, obcordate and black. The antennae are three-jointed. On the ventral side of the first thoracic segment is a pair of feet with setae (fig.3). On the dorsal surface of the eleventh abdominal segment are two cylindrical processes, the extremity of each with a tuft of long hairs. On the ventral surface of this segment are the blood gills, two in number and shorter than in Chironomus. The twelfth segment has the usual anal feet and four blood gills, the latter, however, differing from Chironomus in having at the apex of each a little tuft of hairs.

Pupa. (Figs. 5 and 8) Thorax with short and narrow respiratory tubes. The caudal end is provided with two tufts of long hairs. The species shown by Fries is H. lugubris, an European species.

Imago. Very small black species, the males as well as the females of which have the antennae with short hairs. Head small,

flattened in front; epistome somewhat prominent; proboscis not much extended; palpi short, four-jointed, the last joint somewhat longer than the one which precedes it; antennae of the male 14-jointed (fig.7); the basal joint thick, the last joint elongated and thicker than the rounded preceding joints, short and sparsely haired; the female with a 7-jointed antenna (fig.6), the first and last joint as with the male. Eyes crescent-shaped, the concave side enclosing the antennae, bare; ocelli wanting. Mesothorax produced over the head, well arched; abdomen narrow and long, 8-jointed, hypopygium small (figs. 10 and 11). Legs moderately long, covered with fine, woolly hair; the metatarsi somewhat elongated but not as long as the tibiae; claws distinct, puvilli very small. Wings shorter than the abdomen and with the cell M_1 open; anal angle rounded (fig.9). Halteres free. Fries' figure (copied on pl.34, fig.7) shows the male antennae with but 13 joints, although the description says there are 14.

This genus has not yet been recorded from America.

Genus 32. Doloplastus Skuse

Proc. of Linn. Soc. of N. S. W. 4:260. 1889

Antennae 2+6 jointed in male, otherwise as in female of Orthocladius. Wings naked. Third longitudinal vein (R_{4+5}) nearly straight. Costal vein extending a little beyond tip of third longitudinal (R_{4+5}). Posterior branch of fifth longitudinal (Cu_2) straight. Legs unicoloured. In fore legs the metatarsus considerably shorter than tibia. Forceps of male robust. An Australian genus.

Genus 33. Smittia Holmgren

Kongl. Svenska. Vetensk. Ak. Handl. Bd. 8. no.5. 1869. 47

Front wide, eyes oval, somewhat prominent, at the base of the antennae slightly emarginate. Antennae short, flagellum (female) sparsely haired, 5-jointed (i. e. antennae therefore 7-jointed), the first and the last joint longer than the others. Oral margin slightly produced, palpi rather stout. Thorax like that of other Chironomids. Abdomen somewhat blunt, the tip on both sides with a seta-like tubercle. Wings narrow, short, scarcely reaching the middle of the abdomen; venation much as in Chironomus, but more difficult to distinguish; stouter towards the costal margin. Legs rather long, fore femora stouter, the tarsi a little longer than the tibiae. This genus takes a position between

Diamesa and Chironomus, but easily distinguished from them by the short wings. Type of the genus S. brevipennis (=Chironomus brevipennis Boehem).

It is not stated in the description whether the wings be hairy or bare. From the statement that the tarsi are a *little* longer than the tibiae, it appears that the metatarsus is shorter than the tibiae. The genus may, therefore, be most nearly allied to Orthocladius, Camptocladius or to Metriocnemus. In the description given by the author in Ent. Tidskr. p.181, 1883, it is stated that the abdomen of the male is narrow and the anal end somewhat thickened almost like that of Diamesa. Genus has not been recorded from America.

Genus 34. Burmeisteria Weyenbergh

Tidj. v. Entomol. 130. 1886. (Pl.35, figs. 26-28)

Like Chironomus, but the thorax is narrowed anteriorly and bent downward overhanging the head (fig.27). The halteres are long and flat (fig.28), the stem very short, hence covered by the knob. Wings with ciliated margin (fig.26).

In the generic description given by Weyenbergh the number of antennal joints is not stated; although the statement "like Chironomus" would seem to imply that this genus possesses the same number as Chironomus (i. e. 14). Weyenbergh's figure also shows about this number. Arribalzaga (1893 p.241) states that the genus should be regarded as a synonym of Chironomus sens. str. and further says that the wings are bare.

The type of the genus is B. photophila Weyenb. (loc. cit.), recorded from Argentina. No other species have been recorded.

Genus 35. Diamesa Meigen

Syst. Beschr. 7:12. 1838. (Pl.30, fig.13, and pl.32, figs. 5 and 14)

Larva. The larvae of the known species are yellowish or greenish in color and are found in swiftly flowing water. In form they are of the usual Chironomid type, most resembling those of Orthocladius. The blood gills of the eleventh abdominal segments, which are usually found in Chironomus are wanting in this genus; their absence probably due to the fact

that the larvae are found only in well aerated water. When taken from the streams and placed in still water they soon die, usually within a few hours. (Pl.36, fig.14-25, after Heeger; 1853; and pl.20, fig.9).

Pupa. The pupae are apparently without thoracic breathing organs; if they are present they must be extremely minute and have been overlooked. The anal end with 6 or 8 short setae; the posterior margin of each abdominal segment with spines or setae. (See pl.48, fig.13, in Bul.68, N. Y. State Museum, '03.)

Imago. Head small; broad and flattened in front, the face prolonged into a short broad proboscis; eyes elongate, only a little emarginate, ocelli wanting. Antennae inserted close to the eye margin, 14-jointed in the male, basal joint broad and disk-like, the fourteenth very much elongated like that of the males in Chironomus and of a similar structure; densely plumose; antennae of the female seven or eight jointed (pl.31, fig.7), the joints rounded or oval, the last one somewhat longer and cylindrical. In both sexes the basal joint disk-like. Palpi four-jointed. Thorax highly arched; produced more or less over the head, slightly flattened in front of the scutellum. Abdomen like that of most Chironomids; rather long and slender in the male; shorter and stouter in the female. Legs long and rather stouter than in Chironomus, fore metatarsus equal to or shorter than the tibia; the fourth tarsal joint, of most species at least, short, obcordate. Wings bare, venation as shown on pl.30, fig.13, resembling Tanypus in having the M-Cu crossvein; the subcosta slender, but distinct, R_1 and R_{4+5} ending in the costa; between these is the slender and delicate R_{2+3}; the media is simple; the R-M crossvein oblique; the M-Cu crossvein erect; the cell M is present; the cubitus forks a little before the M-Cu crossvein; the humeral crossvein is present. Genitalia as shown on pl.32, figs. 5 and 14.

Several species have been recorded from Europe and North America. Haliday in Walker's Ins. Brit. III (1856) has recorded species the males of which are said to have bare or short-haired antennae.

KEY TO SPECIES OF DIAMESA

Larvae

a Mouth parts as shown on pl.20, fig.9.....1. waltlii
aa Mouth parts as shown on pl.36, figs. 18 to 25; the dorsal surface of the abdominal segments marked with transverse fasciae (European species).....3. culicoides

Pupae

a Anal end with six slender filaments.....1. waltlii
aa Anal end with eight filaments.....3. culicoides

Imagines

a Halteres pale yellow; thoracic stripes black; length 4.5 to 5 mm. (United States, Europe, Greenland).....1. waltlii
aa Halteres white; thoracic stripes cinereous black; length 2.75 to 4.25 mm. (Greenland).....2. chorea

I cannot separate aberrata Lundbeck (1898) from waltlii.

1. Diamesa waltlii Meigen

1838 Diamesa Meigen. Syst. Beschr. 7:13, 1
1856 Chironomus Halid. in Walk. Ins. Brit. Dipt. 3:194
1864 Diamesa Schiner. Fauna Austr. 2:615
1898 Diamesa aberrata Lundbeck. Vidensk. Meddel. 289, 77

Larva. (Pl.20, fig.9) The larvae were taken in company with the larvae of Thalassomyia fusca among the algae on the surface of rocks over which the water flows rapidly. In color it is pale green, in general appearance and even in many details of structure it greatly resembles Thalassomyia fusca. The dorsal selerite of the head is elongated, shield-shape, with two pairs of marginal setae; on the lateral selerite there is one seta near the base of the mandible just above the lateral line, one pair below this one and a little cephalad; another pair about one quarter of the length of the head caudad of these but lying as far below the lateral line as the first is above. Directly caudad of the first, but midway between the front and hind margin of the head, is another; close to the dorsal suture, one quarter the length of the head cephalad of the caudal margin is still another; and finally there is a single one on each side at the base of the labium.

The mouth parts are as shown in the figure. The epipharynx is shown with its parts extended. In the figure given by the writer in Bul. 68. N. Y. State Museum (1903) these parts are shown folded down. The lateral arms (la) are each expanded apically into a handlike process with 7 or 8 fingers. The mandibles each have 5 blunt teeth, a fringe of coarse-branched hairs projecting mesad, and two stout setae on the dorsal surface near

the base. The labium (1) has about 19 blunt teeth; the antennae are of moderate length, bare, and with three terminal appendages. The entire body appears to be devoid of hairs. The thoracic and anal feet are of the usual Chironomus type. The dorsal tuft of the anal segment is present; blood gills of the eleventh segment absent.

Pupa. The pupa is fuscous in color, with a slightly greenish tinge. Thoracic respiratory organs apparently wanting. On the dorsal posterior margins of each of the abdominal segments, excepting the first and last, there are 10 to 12 short, stout caudad projecting teeth, the two or three lying nearest the lateral margin being smaller than those near the median line; and on the ventral surface of the segments, excepting the first, second and last, there are six or eight stout teeth projecting cephalad. At the anal end there are three pairs of short hollow filaments which may have a respiratory function. The length of pupal life is about two days.

This pupa greatly resembles that of D. culicoides as described by Heeger (1853) excepting that there are eight abdominal filaments in the latter while there are but six in the former.

Described from specimens taken in Cascadilla creek, Ithaca, N. Y. An empty pupal skin from Las Vegas, New Mexico, from Professor Cockerell does not differ from the one described above.

Male. Black; head black, including eyes, mouth parts and antennae, the latter densely covered with long, dark brown hair. Its first joint enlarged, disk-like, the second twice as long as broad, the following 11 a little shorter than broad, the 14th longer than all the rest taken together. The palpi are somewhat shorter than the antennae, four-jointed (besides a small basal piece), the first joint shorter, the fourth longer than the other two. Dorsum of the thorax black, subshining, with a faint cinereous bloom covering the surface, excepting the three slightly raised longitudinal stripes, which are deep black, and between which are arranged some scattered black setae; scutellum dark brown, with black setae; metanotum and pleura black, the latter with a gray bloom; abdomen black, longer than the wings in fresh specimens, covered with fine brown hairs, posterior margins of the segments narrowly cinereous. Genitalia conspicuous and rather complex (pl.32, fig.14); the apical joint of the appendages triangular in outline with a sharp point; the basal joint with a pointed process attached near its base on the inner side, mesad of which are two smaller pointed projections. The dorsal keel is nearly straight and spike-like. Legs uniformly fuscous, all the fourth tarsal joints shorter than the fifth, tarsal

claws simple. Wings broad, and nearly as long as the abdomen in fresh specimens; usually longer than the abdomen in dried specimens; cinereous in color, the anterior veins conspicuous, brownish or black; media and cubitus pale, posterior margin very delicately ciliate. Halteres usually pale, in an occasional specimen brownish, the knob triangular in outline. Length 3.5 to 5 mm. (pl.30, fig.13).

Female. Cinereous black, front and epistome cinereous, eyes but slightly excavated at base of antennae; palpi and antennae fuscous, the latter with 8 joints counting the disk-like basal joint, short-haired (pl.P, fig.7); scutellum hemispherical, dark brown, with black setae; abdomen fuscous with short brown hairs, posterior margins to the segments darker except on the extreme edge, which is pale yellow; genitalia small, brown and leaf-like; legs fuscous; claws simple; wings broad, and longer than the abdomen; anterior veins black; media and cubitus pale; length 3.5 to 5 mm. In other respects like the male. Described from bred and captured specimens. New York, Idaho, Washington State, Greenland.

Fitch's Chironomus nivoriundus, which I formerly considered a synonym of Diamesa waltlii Meig., I now regard as distinct.

According to Lundbeck (1898), D. waltlii does not possess cilia on the posterior margin of the wing, he quoting Meigen as authority for this statement; the European specimens, however, which I have do possess these cilia, as do also my American specimens. The cilia are quite short and rather difficult to see with a hand lens. D. aberrata Lundbeck (1898, p.290), according to its author, differs primarily from D. waltlii in possessing cilia on the posterior margin of the wing; but since waltlii does have the cilia, this distinction fails, and the two names must be regarded as synonymous. In the description of aberrata the scutellum and legs are said to be pale brown, while in waltlii, as described above, they are dark brown or fuscous. These differences are at most only varietal in character; and furthermore, in immature specimens these parts are usually somewhat paler than in mature specimens.

2. Diamesa chorea Lundbeck

1898 Diamesa Lundbeck. Vidensk. Meddel. 291

Greatly resembling D. aberrata Lundb.; its smaller size, obscure coloring, white halteres and more slender legs will distinguish it.

Male. Thorax cinereous, with three cinereous black stripes, the two laterals anteriorly abbreviated, the interval between sparsely hairy, scutellum cinereous brown, pilose, metathorax cinereous-black, the pleura gray, the pectus cinereous-black. Abdomen slender, cinereous-black with yellow hairs, the venter paler, the anal segments wide. Antennae brown, 14-jointed, plumose. Legs more or less dull brown, slender, setose. Halteres white. Wings slightly tinted, nearly hyaline, the margin short ciliate, the venation like that of D. aberrata. The fourth tarsal joints shorter, or at least not longer than the fifth; the fore metatarsus is somewhat shorter than the tibia.

Female. Antennae 8-jointed, short, the last joint elongate, fusiform, the abdomen shorter and stouter than that of the male; differs from the female of D. aberrata in its smaller size, shorter antennae, and wholly cinereous abdomen. Length of male and female 2.75 to 4.25 mm. Greenland. Translation.

3. Diamesa culicoides Heeger

1853 Sitzb. K. K. Acad. Wiss. Wien. 10:7

The larva, pupa and adult of this European species were described by Heeger (1853). Heeger's figures are reproduced on pl.36, fig. 15 to 25.

According to this author 80 to 100 eggs are laid by the female in groups of 10 or 12 upon stones or other objects along banks of the brook where they may be washed by the water from time to time. The eggs are described as being yellowish-white, nearly cylindrical, slightly smaller at one end, scarcely .25 mm. in length and nearly one-half as wide. The larvae emerge in about 8 or 10 days. They are white in the beginning; later the dorsal surface becomes brownish. When full grown about 12 mm. in length. The eyes are subtriangular, small, flat and black; the labrum is rounded, brownish-yellow, chitinous, scarcely one-sixth as broad as the head, one-half as long as broad, with four rounded teeth. The lower lip is one-half as broad but twice as long as the labrum, pale yellowish, truncated anteriorly, with the anterior margin densely hairy; the palpi are attached basally to this, and have the same structure as the lower lip. The labium is dark brown, is one-fourth as broad as the head, with a semicircular anterior margin, this margin provided with six very short rounded teeth on each side, and in the middle with a broadly truncated one (fig.19); the mandible (fig.18) is subcordate, one-fourth as long as the head, with five short rounded teeth, proximad of which there is a long row of yellowish brown, movable setae. The larva spins a thin, tube-like dwelling from which the head

projects when it is watching for prey. There are three moults. They are found where the water is swiftest.

The pupae greatly resemble those of the Tortricids, are nearly cylindrical, slightly pointed at the apical end, smaller posteriorly, and of a pale brown color, somewhat darker anteriorly (pl.36, figs. 16 and 17). The abdominal segments are provided with setae; those on the dorsal surface projecting caudad, those upon the ventral surface projecting cephalad. The anal end has 8 slender, long, chitinous setae, the apical end of which is bent upwards. The adult is also described, but since it is not an American species, the description will not be reproduced here.

Genus 36. Eutanypus Coquillett

Fur Seals and Fur Seal Islands. 4:341. 1899

Closely related to Tanypus, but the antennae of the female are 8-jointed, of the male 9-jointed, not plumose, the first joint bulbous, about three times as broad as the second; joints two to seven in the female, two to eight in the male, decreasing in length outwardly, the penultimate joint only slightly longer than broad, the ultimate nearly as long as the three preceding joints; eyes deeply emarginate next the antennae, palpi four-jointed. Third vein of the wing simple, fourth issuing from the fifth near its base and forking near the middle of the wing, the fifth also forking near the middle of the wing, its upper branch connected with the fourth by a crossvein; small crossvein and first section of the third vein scarcely longer than broad. Type of the genus E. borealis Coq. loc. cit.

It appears from this description that the wing venation must greatly resemble that of Diamesa, the number of antennal joints and the lack of long antennal hairs distinguishes the male of the genus from Diamesa. The females of Eutanypus cannot be distinguished from those of Diamesa. The third vein spoken of in the above description appears to be R_{2+3}; the anterior fork of the fourth seems to be equivalent to R_{4+5}, and the posterior fork the same as the media; the fifth is the same as the cubitus. Compare the figure on pl.36, fig.13.

Eutanypus borealis Coquillett

1899 Eutanypus Coq. Fur Seals and Fur Seal Islands. 4:341

Female. Head black, opaque gray pruinose, the antennae, palpi, and proboscis brownish black, the antennae nearly twice

as long as the head. Thorax, scutellum, and abdomen black, opaque gray pruinose, the sparse hairs chiefly yellow. Wings 1.5 times as long as the abdomen, whitish hyaline, veins yellow or brownish; the third, except at its base, the fourth before its point of furcation, also its posterior branch, both branches of the fifth and the whole of the sixth almost colorless; the crossvein at the outer end of the second basal cell unites with the upper branch of the fifth a short distance beyond its base, and with the fourth a short distance before its furcation; the small crossvein at about twice the length of the outer crossvein beyond the base of the upper branch of the third[1] vein; the first vein extends to the last fifth of the length of the wing. Legs brownish black, first joint of the front and the hind tarsi two-thirds as long as their tibiae, the fourth joint noticeably widened, about three-fourths as long as the fifth; tarsal claws simple and of equal length. Halteres yellow. Length 3.5 mm. Bering Island.

An immature male specimen collected at the same time and place differs from the female in having the palpi, antennae, scutellum and the legs yellow. A female collected on the summit of Mt Washington, N. H., by Mrs Annie T. Slosson, does not differ from the female above described. (Coquillett, loc. cit.)

The description given above of the female would apply very well to Diamesa waltlii.

Group Chironomus Meigen

Meigen. Illiger's Magazin. 2:260. 1803

The eggs. The eggs of the members of this group are deposited, usually in the water, in the form of a long string or in a clump, surrounded by a layer of gelatine. The arrangement of the eggs within the egg string seems to be constant for a given species (pl.31, figs. 12 to 15). Miall and Hammond (1900) say, "In C. dorsalis the egg mass is a transparent cylinder with rounded ends, about 20 mm. long, formed of a mucilage secreted by the gluten-gland, in which the brownish eggs are imbedded. The eggs do not lie at random, in the cylinder, but are lodged in a special winding tube or egg-pipe, which lies near the surface of the egg mass, and makes many almost complete spires, curving around from right to left and from left to right alternately (pl.31, figs. 13 and 14). The tube itself only becomes visible when the egg

[1]This should probably read "4th vein", because in the generic description the third vein is said to be simple; i. e. unbranched.

mass is boiled or treated with hardening agents. The interior of the cylinder is traversed by interwoven cords. As many as 19 spires have been counted in one egg mass and since each spire commonly contains about 45 eggs, the total may amount to 850 or even more."

In an undetermined North American species observed by the writer, the egg mass is in the form of a clump enveloped in gelatine, which is moored by means of a cord to a stone or a weed along the bank of a pool. The eggs within this clump have no definite arrangement but lie at random (fig.10). Another North American species lays a string in which the eggs are arranged as shown in fig.15, and still another as shown in fig.12.

Larva. All the larvae of the members of this group are rather slender, have a rather short head, and possess thoracic and anal prolegs (pl.16). In size the mature larvae vary from 4 or 5 mm. to upwards of 25 mm. Many of the largest species are blood red in color, while the smaller ones are yellow, light or dark green, brownish, or pink. The head is small, brownish in color, heavily chitinized, and a little longer than wide. The sclerites of the head consist of a dorsal, ventral, and two lateral plates, besides a number of smaller ones. The dorsal sclerite is elongate shield-shaped, often with a few setae. Attached to the front margin of this plate is the labrum, which hangs flap-like in front of the mouth and may be bent backward; and on the under surface are several pairs of setae, usually pectinate. Attached to the ventral surface of the labrum is the epipharynx. This is a rather complex structure; it is attached at its anterior margin, its free margin projects ventrad and caudad. Its form varies in the different genera. The lateral plates bear two pairs of rudimentary eyes (pigment spots) as well as the antennae and the jaws. The antennae (pl.16, fig.5, and pl.22, fig.1a) are situated on the anterior end of the lateral plates; they consist of a comparatively long basal joint and several shorter terminal ones. The mandibles (pl.22, fig.1, md) situated ventrad of the antennae are stout and have a four or five toothed margin. They are articulated in such a manner that they move in an oblique plane, striking the labium (pl.16, fig.5). The labium is attached or rather is coalescent with the front margin of the ventral sclerite of the head, the suture separating

the sclerite from the lateral ones only faintly marked. Miall and Hammond (1900) consider the ventral piece as a portion of the lateral sclerite. The margin of the labium is toothed (pl.22, fig.1 l); the size and arrangement of the teeth vary in the different species. Near the base and ventrad of the mandibles are the maxillae (fig.1 mx) consisting of fleshy processes, with a short cephalad projecting palpus (fig.1 p), and some setae and papillae. On each side of the labium is a striated and flexible fan-shaped flap which helps to close in the mouth. On the floor of the mouth cavity, lying close to the labium, is the hypopharynx (fig.1 hy), with various setae and papillae. The prothoracic pair of feet is furnished with a large number of slender, curved hairs, sometimes pectinate, the two feet very close together so that they appear almost as one (pl.21, fig.8). The first three segments of the body in specimens which are ready to transform are enlarged and represent the thorax; the intermediate segments of the abdomen are subequal in length and usually have a few setae. On the ventral surface of the eleventh segment of those species which are blood red in color there are two pairs of long blood gills pl.16); on the caudal end of the dorsal aspect of the last segment are two small papillae each surmounted by a tuft of a few long hairs; ventrad of these there is a bunch of four short blood gills. The anal feet are about as long as the eleventh segment, each one with a crown of from 10 to 20 bifid claws (pl.21, fig.9).

Pupa. The pupa is somewhat elongate, the thorax enlarged, and the abdomen 8-segmented, not counting the anal appendages (pl.16 and pl.23, fig.9). Upon the cephalic end of the thorax are the respiratory organs, which may consist of a pair of much branched filaments, or a pair of tubes or knobs, or may be entirely wanting. On the abdomen there are frequently a few lateral filaments, and at the caudal end of the lateral fins of the eighth segment there is often a chitinized comb or spur (pl.22, figs. 8 and 26) with a variable number of teeth depending upon the species. Usually the dorsum of each abdominal segment is marked by a large number of short and very minute setae arranged in some constant pattern for a given species (pl.22, figs. 3, 12, 13, 14, 15). The ninth or anal segment may be provided with a fringe of matted hairs, forming a paddle, or may have only a few characteristic setae.

Imago. Rather large to very small species, characterized by the structure of their antennae and the wing venation. Head small, somewhat compressed laterally; epistome somewhat prominent, and usually hairy; proboscis short; palpi incurved, four jointed, the last joint somewhat elongated. Antennae of the male 14-jointed, the first joint large, disk-like; the second cylindrical, the following ones rounded and closely crowded, the last joint very long, often as long as the others taken together; all long plumose; that of the female 7-jointed, the first disk-like, the second cylindrical, the following egg or pear-shaped, short verticillate, the last one cylindrical or ellipsoidal, short-haired; eyes reniform, ocelli are wanting. Mesothorax highly arched, projecting over the head, without transverse suture, with a depressed area in front of the scutellum; the pectus deeply arched, scutellum small; metanotum well developed. Abdomen long and narrow, compressed cylindrical, 8-jointed; hypopygium tong-like. Legs very slender and long, especially the anterior pair, which are widely separated from the following pairs; coxae elongated, the tibiae sometimes very short, and the metatarsi often much elongated, the vesture woolly and short, sometimes fringe-like; claws and pulvilli present. Wings long and slender, hairy or bare, folded over the abdomen when at rest; in the male often shorter than the abdomen. Venation as in the figures on pls. 28, 29, 30, and 31; anal angle present; the halteres free.

Van der Wulp (1874) divided this group into a number of genera, using as characters for the subdivisions the relative length of the fore tibia to the metatarsus, the condition of the wing, i. e., whether hairy or bare, and the course of the cubitus. Descriptions of these genera are given on subsequent pages.

Genus 37. Thalassomyia Schiner

Verh. zool. bot. Gesell. 6:218. 1856

This genus was erected by Schiner (loc. cit.) to contain the species T. frauenfeldi, of which only the female was known. More recently Dr Tömösvary (1884) described another species T. congregata, and in 1903 the writer described the male and female of a third, T. obscura. Coquillett (1902) described a fly which he called Orthocladius

platypus from Arizona and which probably also belongs to this genus, making four species thus far known.

The eggs of T. congregata are laid in strings of gelatine, in which the elongate oval eggs are placed. The larvae of the two species of which they are known live in rapidly flowing water. Here the larva spins upon the surface of the rock a cocoon so loose, transparent, and open that it is not hidden by it, though it prevents the larva from being washed away. The larva greatly resembles Diamesa from which the one American species which is known in the larval state can be distinguished by the form of its labium. The larva is pale green in color with a dark brown head, and without blood-gills on the ventral surface of the eleventh segment. The pupa is apparently without thoracic respiratory organs; and the dorsal surface of the abdomen is provided with numerous setae.

Imago. The genus resembles in many respects both Orthocladius and Diamesa; from the former it may be distinguished by its having the fourth tarsal joint of all the feet in both sexes obcordate and shorter than the fifth; from the latter genus in having no M-Cu. crossvein (pl.30, fig.12).

Head small, broad, eyes elongate, somewhat emarginate, ocelli wanting. Antennae 14-jointed in the male, long, densely haired, the 14th joint like that of Chironomus; antennae of female 7-jointed, sparsely short-haired, joints rounded, basal joint of both male and female flattened, disk-like. Palpi 4-jointed. Thorax arched. Abdomen of the male moderately slender, of the female shorter and stouter. Legs moderately slender, fore metatarsus shorter than the tibia, the fourth tarsal joint of all the feet in both sexes shorter than the fifth and obcordate. Wings bare, venation resembling that of Orthocladius, the M-Cu. crossvein wanting. The forking of the cubitus may be either proximad or distad of the R-M crossvein.

KEY TO SPECIES OF THALASSOMYIA

Imagines

a Dorsum of thorax blackish with indications of three stripes; humeral spots, scutellum, and pleura yellowish or brownish; abdomen dull black, first two segments greenish; length 3 to 5 mm. (New York)
1. obscura

aa Thorax black, humeral spot yellow; length 2.5 mm. (Flagstaff, Arizona)
2. platypus

1. Thalassomyia obscura Johannsen

1903 Thalassomyia Johannsen. N. Y. State Museum bul. 68. 437

Larva. The eggs were not found. The larva is 8 to 10 mm. in length when full grown, pale or yellowish green in color, its head is dark brown and heavily chitinized. The head is somewhat longer than wide, the dorsal suture well marked. Two setae are placed immediately in front of the transverse suture, and at the apical end of the labrum are two more. The lateral arms of the ventral surface of the labrum are rather short and stout, and somewhat pointed. The anterior ventral margin of the labrum is provided with short fleshy filaments instead of setae as is usually the case in Chironomus. The antennae are small, the basal joints about four times as long as wide, each with two terminal pieces, one of which is four-jointed, the other simple. The mandible is about twice as long as broad, with five blunt teeth; articulated at the base is a long slender process with four terminal spines. The maxillae are short protuberences, covered with pointed projections, with a very short palpus with its terminal papillae, and two stout setae projecting ventrad. The hypopharynx is tongue-like, with two long basal pieces. Its apex and its dorsal surface are covered with pointed papillae; ventrally there is an open arched rib. At the cephalic end of the ventral sclerite, and coalescent with it, is the labium, with 11 blunt marginal teeth, the middle one wide and broadly truncated. On the prothoracic segment are the two prolegs, each with about 30 long curved spines, and a number of short and very small spines on the ventral surface. At the base is a single slender seta, on each side a little dorsad of the lateral line are two more, and caudad of these and below the lateral line a group of three. The eleventh segment is without blood gills; the twelfth with two comparatively short legs, each with a crown of 8 to 10 bifid claws; on the dorsal surface are two small protuberences upon each of which is a tuft of five or six long setae. Between the legs and projecting caudad are four short blood gills.

Pupa. The pupa is about 4.5 mm. long, with the colors of the adult. It is much shorter in comparison to its breadth than is Chironomus. The wings extend to a little beyond the posterior margin of the second abdominal segment. Eight segments are present besides the short anal segment. On the dorsum of each segment, toward the caudal margin, is a transverse band of stout black bristles. Each band is composed of five or six rows. The most caudad of these rows contain the longest bristles. The anal segment is composed of two small lobes, each with a single apical bristle. After two to four days of pupal life it transforms into the imago. (See pl.50 in N. Y. State Mus. Bul. 68.)

Imago, male. Front and epistome yellow, palpi fuscous, shorter than the antennae, its first joint about 1.5 times as long as broad, the second twice, the third three times and the fourth four times as long as the first. Antennae fuscous, 14-jointed, the first disk-like, the second longer than broad, the third to the thirteenth about as long as broad, the fourteenth longer than all the others taken together; all furnished with long brown hairs except the apical one-fourth of the fourteenth. Dorsum of the thorax blackish; yellow on the humeri and pleura, covered with a white bloom, most conspicuous on the humeri. The dorsum of the thorax has a dirty yellow ground color, but the three black longitudinal stripes are so wide that only a little of the ground color shows, excepting on the humeri and the two very narrow faint longitudinal stripes separating the three wide, black ones; the scutellum is chestnut; metathorax black; pectus brown; abdomen dull black, the dorsum of the first two segments greenish; the extreme edge of each segment, paler fuscous; the venter greenish, darker, almost black on the more posterior segments. The green is sharply separated from the dorsal color on a lateral line. In dried specimens this green color becomes dusky; legs almost black, the coxae and the bases of the femora yellowish, fore tarsi only pubescent, not hairy; fore metatarsus about three fourths as long as the tibia; tarsal claws simple; wings hyaline, hairless, the anterior veins yellowish, the rest hyaline, venation as in fig.12, pl.30; anterior and posterior margins delicately ciliate; genitalia inconspicuous. Halteres white. Length 3 to 5 mm.

Female. Antennae seven-jointed, black, with short hairs. Thorax with black stripes a little narrower than in the male, hence the yellow stripes separating them and those on the humeri more conspicuous. Pectus, scutellum, and a little space in front of the latter brown; the pectus in dried specimens sometimes nearly black; pleura yellow, metanotum black; abdomen as with the male, but the venter is paler; legs black, coxae and bases of femora yellow; tarsal claws simple; wings hyaline, anterior margin and tip a little dusky; anterior veins yellow; wing margins delicately ciliate; venation as with the male; halteres white. Length 3 to 5 mm. Many captured and bred specimens. Ithaca, N. Y.

2. Thalassomyia platypus Coquillett

1902 Orthocladius Coquillett. Proc. U. S. Nat. Museum. 25:93

Black, a large dull yellowish humeral spot, halteres, trochanters, and extreme bases of femora yellow; hairs of antennae dark gray, thorax opaque, grayish pruinose; tarsi only pubescent, the fourth joint dilated, emarginate at the apex, noticeably shorter than the fifth, first joint of front tarsi three fourths as long as the tibiae;

wings hyaline, small crossveins not darker than the adjacent veins, not clouded with brown, third vein beyond its middle slightly bowing toward the costa; length 2.5 mm. Male. Flagstaff, Arizona. New Jersey (Johnson).

Thalassomyia frauenfeldi Schiner

Theobald in "An Account of British Flies," p.202, reproduces a note of Mr Swainson, which reads in part as follows:

" . . . I found this larva several times on Obelia zoophytes growing at the end of St Anne's pier. Next I found it on some Coryne from the Mumbles (Swansea) and more recently I dredged it from fifteen fathoms off Spanish Head (Isle of Man) adhering to seaweed. Professor Miall, of Leeds, to whom I sent specimens, thought it would ultimately turn out that Johnston's Compontia was Schiner's Thalassomyia frauenfeldi. This seems very possible, as the descriptions are very similar. . ."

The figure given by Theobald (1892) is reproduced on pl.34, fig.1.

Genus 38. Chironomus Meigen

Illiger's Magaz. 2:260. 1803. (Chironomus, part)

Larva. The larvae of this genus differ from those of the other genera of the group Chironomus primarily in the form of the mouth parts, and are known as bloodworms; some species, however, have pale larvae. The antennae are short, with the first joint nearly twice as long as the remaining four taken together. Set on the end of the first joint, there is, besides the second joint an unsegmented appendage. On the under surface of the labrum are several pairs of setae and sometimes a pair of fan-shaped organs, perhaps sense-organs. The epipharynx is well developed, and on each side of it is a long chitinized, sickle-shaped process, which are called the lateral arms in the following descriptions (pl.22, fig.10 la, and pl.23, fig.10 lr). At the anterior margin of the epipharynx is a minute comb with caudad projecting teeth (pl.23, fig. 10 c); caudad of these is a horseshoe-shaped piece with the open end projecting cephalad (fig.10). Within this arch are several curved pectinate setae, which may be erected, though they are usually folded down as shown in the figures. The maxilla has, besides the rather prominent palpus, some cephalad projecting filaments on the outer lateral margin and a number of setae, papillae and filaments on the inner margin (pl.22, fig.1 mx). The eleventh abdominal segment has usually though not always two pairs of blood gills besides those on the twelfth segment.

Pupa. The pupa usually remains within the tube constructed by the larva, but is capable of swimming freely like a frog larva. It is provided with a pair of much branched thoracic filaments, and its caudal segment is fringed with long matted hairs or filaments forming a paddle (pl.23, fig.9 f).

Imago. The genus Chironomus as restricted by Van der Wulp (1874 and 1877, p.245) is defined by him in the latter work as follows: Face usually hairy, lengthened downward snout-like; proboscis short, palpi bent, 4-jointed, the last joint elongated. Antennae filiform, in the male 14-jointed, the first joint short, disk-like, the second cylindrical, the following rounded, closely sessile, the end joint very long and slender, all long and densely plumose; toward the tip the hairs become gradually shorter; in the female the antennae are much shorter, 7-jointed; the first joint short, disk-like, the second cylindrical, the following four oval, sparsely haired, the last joint somewhat elongate. The eyes on their mesal margin deeply emarginate, ocelli wanting: Thorax highly arched, more or less projecting over the head, flattened in front of the scutellum, pectus very prominent, scutellum small; metanotum well-developed; the markings of the thorax, if not unicolored, consist of three, usually wide longitudinal stripes, of which the median is posteriorly and the two laterals anteriorly abbreviated; sometimes the median stripe is divided longitudinally by a fine line, which continues to the scutellum. Abdomen cylindrical, in the male sometimes flattened, the last or anal segment distinctly separated from the preceding, longer than broad, the genitalia projecting tong-like, the claspers filiform or leaf-like. Legs long and slender, particularly the fore pair, of which the tibiae are frequently very short, while the fore metatarsus is always longer than its tibia; the fore tarsi of the male are sometimes peculiarly haired; the tarsal claws and pulvilli upon all the feet are small but distinct. The wings are bare, in the male often shorter than the abdomen, the anal angle always present, sometimes strongly projecting; subcostal vein delicate but distinct, as is also R_1 which enters the costa beyond the middle of the wing; R_{4+5} emerges from the small crossvein, at its extremity usually slightly curved downward, entering the margin not far from the apex of the wing; the media is unbranched and joins

the wing margin at or a little below the apex; the cubitus is forked; the R-M crossvein is at about the mid length of the wing; the humeral crossvein is sometimes wanting.

To the above description I may add that R_{2+3} is present though usually quite delicate. The male genitalia consist of a dorsal downward curved keel, a pair of elongate lateral lobes, a pair of inferior and a pair of superior lobes (pl.32, fig. 7 to 13).

KEY TO SPECIES OF CHIRONOMUS

Larvae

The tooth on the middle line of a labium having an odd number of teeth will be called the middle or median tooth, the first tooth laterad of this will be called the first lateral; the second, the second lateral, and so on. When there is an even number of teeth, the first one laterad of the median line will be called the first lateral; the second, the second lateral, etc.

a Labium with an odd number of teeth (i. e. center line bisects the middle tooth)
  b Middle tooth broadly truncate, pl.21, fig.18; pl.23, fig.15
    c First lateral tooth smaller than the second, second truncate, pl.23, fig.15.....59. ?plumosus
    cc First lateral about same size as the third.....16. flavicingula
  bb Middle tooth rounded
    c Middle tooth trilobed
      d Teeth short, pl.23, fig.8.....60. decorus n. sp.
      dd Teeth long, pl.23, fig.13.....79. Chir. sp.
    cc Middle tooth simple
      d First and second lateral teeth rather closely united, pl.21, fig.1
        e Teeth as shown on pl.21, fig.1.....25. tenellus
        ee First and second laterals more distinctly separated than shown on this plate.....48. dux n. sp.
      dd First and second laterals as distinctly separated as the other teeth
        e Middle tooth shorter than the first laterals; blood red larva 80. Chir. sp.
        ee Middle tooth as long or longer than the laterals
          f Second and third laterals longer than the first laterals and closely united, pl.37, fig.27.....63a. tentans
          ff Not as above
            g Second laterals longer than the first and third
              h As shown on pl.23, fig.1.....60a. dorsalis
              hh As shown on pl.37, fig.25.....63. prasinus
            gg Teeth gradually becoming smaller from the median line towards the lateral margin
              h Teeth almost uniform in size, pl.22, fig.7..81. Chir. sp.
              hh Middle tooth distinctly larger
                i Middle tooth semicircular, pl.23, fig.3..52. lobiferus
                ii Middle tooth hyperbolic, pl.22, fig.11..43. modestus

aa Labium with an even number of teeth
b The two middle teeth much paler in color than the others, pl.22, fig.22
82. Chir. sp.
bb The teeth uniformly dark
c Middle pair (first laterals) shorter than the second laterals, pl.22, fig.24 .....44. fulviventris n. sp.
cc Middle pair as long or longer than the laterals
d Middle pair (first laterals) noticeably longer than the second laterals
e Third laterals longer than the second, pl.22, fig.1
41. flavus n. sp.
ee Third laterals about same size as the second; bloodworms, pl.21, fig.6 .....32. nigricans n. sp.
dd The middle pair about the same size as the second laterals; bloodworms, pl.23, fig.6, No. 83; and pl.22, fig.21, No. 84

Pupae

aa Lateral fin of the eighth abdominal segment terminates in a spur, which may be simple or toothed
b Spur simple, without teeth
c Abdominal segments each with a few long setae, pl.22, fig.20
40. ?fulvus n. sp.
cc Abdominal segments each with a pattern of very minute spines
d Spurs of eighth segment stout, pl.23, fig.12..60. decorus n. sp.
dd Spurs slender and seta-like
e See pl.22, figs. 8 and 12.....43. modestus
ee See pl.21, figs. 2 and 3.....25. tenellus
bb Spur, if present, with teeth
c Spur wanting, pl.22, fig.14.....43b. Var. of modestus
cc Spur present
d Large species over 15 mm. in length, pl.23, fig.14
59. ?plumosus
dd Smaller species
e Each abdominal segment with a fuscous transverse band near the anterior margin, produced at the ends into lateral longitudinal vittae, pl.22, figs. 3 and 4.....41. flavus n. sp.
ee Not so marked. Species from Saranac Inn, pl.22, figs. 13 and 17, and fig.18 (perhaps Tanytarsus sp.)
aa Lateral fin with a comb of three or more teeth
b Comb with three distinct teeth, pl.22, fig.26
44. fulviventris n. sp.
bb Comb not as shown in this figure
c The median abdominal segments each marked with three transverse bands; the first and third narrow, the middle one wide with a number of hyaline spots, pl.21, figs. 16 and 17
16. flavicingula
cc Abdominal segments not so marked
d In nearly mature pupae may be seen the lobes on the dorsum of each abdominal segment of the enclosed imago, pl.23, figs. 4 and 5.....52. lobiferus

dd Not as above

e Dorsum of each median abdominal segment marked with spines of several sizes; those in a transverse row near the anterior and the posterior margins are most prominent
32. n i g r i c a n s n. sp.

ee The spines most conspicuous in two oblong patches beyond the middle of each segment

f The teeth of the comb of the eighth segment projects caudad, pl.22, figs. 15 and 16.....43a. Var. a of m o d e s t u s

ff Teeth of the comb of the eighth segment project laterad. Markings on the abdomen resembles pl.22, fig.15, but covers more area on the anterior segments.....48. d u x n. sp.

Weyenbergh (1874) gives a few notes on the larvae of several species, among others, C. n u b e c u l o s u s, d i v e r s u s, r i p a r i u s, a n n u l a r i s, c h l o r i s, v i r e s c e n s, and t e n t a n s. Of t e n t a n s only is a description given. Doctor Dyar (1902) gives descriptions of larva and pupa of C. a n o n y m u s Will. (No. 55). This description is in part reproduced on a subsequent page.

Imagines

Most of Say's and Wiedemann's species have been recognized and have been placed in the following key. Of Walker's species only one or two have been recognized and for this reason a separate key is given upon a subsequent page for them:

a Wings with spots or cross bands

b Dorsum of thorax polished black (humeri may be yellow)

c Humeral region of thorax tinged with yellow, wing with only a faint cloud .....1. b r a c h i a l i s

cc Thorax entirely black (var. of above?).....2. a t r i m a n u s

bb Dorsum of thorax not polished black

c Wings with spots

d Each wing with about eleven spots; brownish or greyish species; 3 mm. in length (New Mexico).....3. v a r i p é n n i s

dd Wings not so marked

e Thorax pale yellow, wing with four spots; length 1.2 mm. Cuban species.....4. o c t o p u n c t a t u s

ee Thorax brownish

f Wing with three dark spots; thorax indistinctly striped; abdomen dusky; length 2 to 2.5 mm.....5. s c a l a e n u s

ff Wing with five or six spots, or bars; abdomen of female with whitish posterior margins to the segments; length 2 mm. (St Vincent Island).....6. s p i l o p t e r u s

cc Wings with cross bars

d Brownish species; abdomen of female black with white posterior margins to the segments; length 2 mm. (St Vincent Island)
6. s p i l o p t e r u s

dd Yellowish or greenish species

e Legs pale; tibiae with black tips; thorax and abdomen yellow; length 4 mm. ..... 7. fascipennis

ee Some or all femora partly black; metanotum with brown vittae or spots; length about 4 mm.

f "Metanotum marked with a transverse pair of triangular brown spots" ..... 8. taeniapennis

ff "Metanotum marked with a pair of brown spots which approach each other posteriorly." (This may be a synonym of the taeniapennis above) .. 9. pulchripennis

aa Wings unmarked, excepting sometimes with darkened crossvein

b Dorsum of thorax and abdomen black. The former may have indistinct stripes and the latter may have paler incisures

c Legs black or fuscous

d Thorax shining black

e Halteres white; wings white, immaculate; male; length 2.75 mm. ..... 10. brunnipes

ee Halteres with brown knob; wings hyaline, very slightly smoky, with anterior veins and crossvein brown; fore metatarsus nearly twice as long as its tibia; length 3.5 mm. 11. brunneipennis n. sp.

dd Thorax grayish, with black stripes; abdomen black

e Abdomen uniformly dark brown or black; halteres white with end of knob brown ..... 12. caliginosus n. sp.

ee Abdomen with whitish incisures or margins

f Fore metatarsus ⅛ longer than its tibia; halteres dark in the male, paler in the female; anterior tarsi of the male with long hairs ..... 13. niveipennis

ff Fore metatarsus ¼ longer than its tibia

g Anterior tarsi of the male long-haired; abdominal segments with narrow white posterior margins; wings hyaline with black crossvein (Greenland) ..... 14. hyperboreus

gg Anterior tarsi of the male short-haired; abdominal segments with cinereous margins; wings slightly cinereous 15. staegeri

cc Legs more or less pale

d Halteres with gray or black knobs

e Femur black with yellow apical ring; tibia black and yellow; wings with black crossvein ..... 16. flavicingula

ee Legs not so marked

f Mesonotum and scutellum shining black 11. brunneipennis n. sp.

ff Mesonotum pruinose, scutellum yellowish; length 2.3 mm. 17. halteralis

dd Halteres with pale knobs

e Basal joint or joints of abdomen yellow

f First and second abdominal segments yellow; male 18. nitidellus

ff First segment only yellow ..... 19. fallax n. sp.

ee Basal joints black

f Crossvein clouded with black or brown

g Fore metatarsus about 1½ times its tibia in length; anterior tarsi of both sexes very slender and without hairs or with but few hairs; legs pale.....20. riparius

gg Fore metatarsus less than 1¼ times its tibia in length; anterior tarsi of the male bearded

h The second fore tarsal joint shorter than the third; male fore tarsi long and densely bearded....21. barbipes

hh The second fore tarsal joint longer than the third; male fore tarsi long but thinly bearded....22. annularis

ff Crossvein not clouded

g Length about 7 mm.; black, abdomen black, in the male sometimes with yellow latteral spots; male fore tarsi delicately bearded; fore metatarsus about 1½ times the length of its tibia.....23. dispar.

gg Length less than 6 mm.

h Thorax shining black, not striped; abdomen black

i Legs blackish, fore metatarsi white; length 4 mm. 24. albimanus

ii Legs pale yellow; abdomen of female with paler base; length 3.5 mm.....25. tenellus

hh Thorax duller, with indications of black or grey stripes

i Abdomen either olive green, or black and white

j With dark olive green abdomen; legs ferruginous; length 4.5 mm.; male.....26. chloris

jj With white posterior margin on each abdominal segment; legs black and white; length 4 to 5 mm.

k Fore femora black, fore metatarsus less than 1.33 times as long as its tibia.....27. devinctus

kk Middle section of each femur, white; fore metatarsus about 1.66 times its tibia in length 28. californicus n. sp.

ii Abdomen black

j Thorax blackish with black stripes; legs wholly white, except sometimes middle section of fore femora is brownish (abdomen of male is white); female .....32. nigricans n. sp.

jj Thorax dark brown with broad yellowish median vitta on anterior half and a pair of gray vittae on posterior part; abdomen velvet-black, hairs yellow (District of Columbia).....29. palliatus

bb Thorax or abdomen or both with considerable green or yellow or gray

c Thorax entirely shining black, excepting sometimes the humerus, which may be yellow

d Abdomen yellow with brown bands.....1. brachialis

dd Abdomen bright green, paler when dry, posterior segments darker

e Halteres wholly pale.....30. pedellus

cc Halteres with black tip.....31. p e d e s t r i s
cc Thorax not shining black
d Legs dark brown; thorax yellow with three black stripes; female 10. b r u n n i p e s
dd Legs more or less yellow
e Thorax dark brown with three broad black stripes; abdomen nearly white, excepting sometimes the last three segments; incisures occasionally slightly fuscous
f Legs white, the middle section of each fore femur occasionally brownish; male.....32. n i g r i c a n s n. sp.
ff Legs white, apical one third or one half of each fore femur and basal one third or one half of each tibia black; middle and hind knees sometimes also darkened; last three abdominal segments blackish; male.....30. p e d e l l u s
ee Thorax not so marked when the abdomen is pale
f Abdomen fuscous, the anterior segments yellowish green 33. a b e r r a n s n. sp.
ff Abdomen not marked in this manner
g Abdomen nearly uniform in color
h Abdomen brown, olive green or black
i Abdomen dark olive green; legs ferruginous; fore femora dark; crossvein not clouded; female 26. c h l o r i s
ii Abdomen dark green, brown or black
j Thorax yellow unstriped; abdomen brown; legs yellow; length 3 to 4 mm. (St Vincent Island) 34. l u g u b r i s
jj Thorax brown or yellowish with stripes
k Legs wholly yellow; abdomen black with yellowish base; female.....25. t e n e l l u s
kk Legs partly brownish
l Thorax dark brown with broad yellow median vitta, and a pair of gray vittae on posterior part; abdomen velvet black; anterior femora brownish .....29. p a l l i a t u s
ll Thorax with black or brown stripes
m Halteres pale; female with dark greenish abdomen; fore metatarsus nearly twice as long as its tibia.....35. f u m i d u s n. sp.
mm Knob of halteres with a dark tip; abdomen fuscous .....12. c a l i g i n o s u s n. sp.
hh Abdomen pale, bright green or yellow; in dried specimens sometimes somewhat brownish; crossvein uncolored
i Species exceeding 6½ mm. in length
j Abdomen of female yellow; male with darker markings in front of incisures; pectus, metanotum and scutellum pale; dorsum yellow with three dark yellow stripes; length 6.5 to 7.5 mm...36. t e n d e n s

jj Thorax pale greenish, with a "fuscous longitudinal line on the anterior dilated line"...37. l i n e a t u s

ii Species less than 6 mm. in length

j Thorax reddish yellow, shining, with three dark brown stripes; metanotum brown, scutellum yellow; abdomen green (when dried sometimes brownish); legs yellow; tarsal articulations usually darkened; fore metatarsus but little longer than its tibia; length 5 to 6 mm.....38. a l b i p e n n i s

jj Not as above; thoracic stripes buff-colored

k Thorax and abdomen green, the former with a median black line, besides the usual buff-colored stripes; metanotum with a black spot; length 5 mm. .....39. t a e n i o n o t u s

kk Thorax without the black median line

l Species having the fore metatarsus more than 1⅔ times as long as its tibia

m Yellow species (in dried specimens)

n Deep yellow species, usually 3 to 4.5 mm. in length; fore metatarsus about 1.75 times the length of its tibia; female
40. f u l v u s n. sp.

nn Pale yellow species with a striped thorax; abdomen having a greenish tinge in living specimen; length 2 to 2.5 mm.
41. f l a v u s n. sp.

mm Abdomen green and usually thorax also

n Fore tibia two thirds as long as its femora, fore metatarsus nearly twice as long as the tibia; length 3.5 to 4.5 mm.
42. b r e v i t i b i a l i s

nn Fore tibia more than two thirds as long as the femora

o Species 3.5 mm. or more in length

p Male genitalia with the lateral arms slender, and somewhat lanceolate; thorax with buff-colored stripes; its ground color greenish yellow or yellow in the male; green in the female
43. m o d e s t u s

pp Genitalia of male with the lateral arms much prolonged and clubbed at the end, pl.32, fig.9
43. Var. b. m o d e s t u s

oo Species 3 mm. or less in length
43. Var. a. m o d e s t u s

ll The fore metatarsus less than 1.4 times as long as its tibia

m Yellow or whitish species

n Deep yellow species; female with greenish tinged abdomen; male with brown abdominal fasciae; fore metatarsus about 1⅛ times as long as its tibia; length 4 to 5 mm. .....44. fulviventris n. sp.

nn Species with white or very slightly green-tinted abdomen; thorax testaceous; knees blackish, fore metatarsus about 1.25 times as long as its tibia; length 4 mm. (See also No. 54).....45. pallidus n. sp.

mm Green species

n Joints of the legs each with a moderately wide black apical band; fore femora and fore metatarsus of about equal length and each about 1.33 longer than the tibia 46. frequens n. sp.

nn Joints of legs without distinct black apices

o Fore femora and tibiae of equal length; fore metatarsus about 1.33 times as long as the tibia; fore tarsi of male hairy 47. viridis

oo Fore femora noticeably longer than the tibiae; fore tarsi of male bare 48. dux n. sp.

gg Abdomen bicolored, each segment with crossbands or marked incisures which may be light or dark, yellowish or brownish

h Thorax with wide black stripes

i Species over 7 mm. in length; thorax green or greenish yellow in ground color; thoracic stripes shining; legs yellowish, knees, fore tibiae, and tarsi in part, blackish; crossvein clouded....49. viridicollis

ii Species 5 mm. or less in length

j Thorax reddish with black stripes; scutellum black, abdomen yellow and black; legs and antennae yellow; length 5 mm.; male.....50. jucundus

jj Thorax yellow with a blackish V-shaped mark on the dorsum; abdomen yellow with black band on posterior margins of segments 1 and 2; fourth and part of fifth black; metatarsus 1.25 times as long as the fore tibia (St Vincent Island) 51. longimanus

hh Thorax with grayish, brownish or ferruginous stripes

i With an oval lobe or mace shaped prominence on each abdominal segment; wings with faint cloud on crossvein; length 7.5 mm.....52. lobiferus

ii Abdomen not marked in this manner
j Crossvein pale
k Abdomen yellowish green; black or brown markings in front of the incisures
l Thorax pale greenish, the dilated lines yellowish testaceous with a "longitudinal narrow line very distinct and fuscous on the anterior dilated line;" length 7.5 mm. (=lineola Wied.) (Illinois).....37. lineatus
ll Without fuscous line on the anterior dilated line
m Ground color of thorax pale greenish (when recent); abdomen pale greenish, the segments distinctly tipped with blackish above; length 6.5 to 9 mm. (This may be a synonym of tendens).....53. festivus
mm Ground color of thorax yellowish
n Length 6.5 to 7.5 mm. Abdominal segments slightly darker on apical margin
36. tendens
nn Length 5 mm. or less
o Thoracic stripes brownish; fore metatarsus about one fourth longer than its tibia .....51. longimanus
oo Dark yellow species; abdomen yellow with ferruginous transverse bands on the segments; fore metatarsus one eighth longer than tibia; male
44. fulviventris n. sp.
kk Abdomen not marked thus; species 5 mm. or less in length
l Thorax yellow, not striped; abdomen yellow; fore metatarsus one fourth longer than its tibia; length 2 to 2.5 mm.; male (St Vincent Island) .....54. willistoni nom. nov.
ll Thorax striped
m Abdomen yellow with ferruginous transverse bands on the segments; fore metatarsus about one eighth longer than its tibia; legs yellowish; male
44. fulviventris n. sp.
mm Abdomen more or less brown or dusky
n Abdomen black with the first segment and the distal part of the next 2 or 3 yellowish; fore metatarsus twice as long as its tibia; length 4 to 5 mm.; male (St Vincent Island) .....55. anonymus
nn Abdomen not marked in this manner
o Abdomen black with segments 7 and 8 yellow; the fore metatarsus about one third longer than its tibia (St Vincent Island)
56. innocuus

oo Abdomen brown, posterior margins of anterior segments widely yellowish, with cinereous bloom; crossvein indistinctly clouded; fore metatarsus over two thirds longer than its tibia; length 3 to 4 mm. (Illinois and New York)
57. s i m i l i s n. sp.

jj Crossvein clouded with brown

k Brownish species with strongly defined wing veins; length 6 mm.....58. r e d e u n s

kk Not such species

l Fore tibiae blackish; in mature specimens the dorsal stripes and metanotum black; fore metatarsus 1.5 times longer than its tibia; length 7 to 9 mm.....49. v i r i d i c o l l i s

ll Fore tibiae pale

m Large species 10 or 12 mm. in length; fore metatarsus 1.25 times the length of its tibia; male fore tarsi long haired

n With dusky thoracic stripes
59. p l u m o s u s

nn With reddish thoracic stripes
59a. f e r r u g i n e o v i t t a t u s

mm Smaller species

n Dorsum of thorax whitish or pale cinereous or greenish, with reddish stripes

o Fore metatarsus over 1.33 times its tibia in length; male fore tarsi bare

p Metanotum reddish or brownish, fore metatarsus 1.6 times its tibia; length 5 to 7 mm.....60. d e c o r u s

pp Metanotum blackish; fore metatarsus less than 1.5 times its tibia in length
60a. d o r s a l i s

oo Fore metatarsus about 1.2 times its tibia in length; male fore tarsi hairy; abdominal fasciae reddish, incisures whitish; length 7.5 mm. 61. s t i g m a t e r u s

nn Dorsum of thorax with brown or cinereous stripes

o Length 3 or 4 mm.; fore metatarsus about two thirds longer than its tibia
57. s i m i l i s

oo Larger species

p Fore tarsi of male bare

q Male claspers slender; fore metatarsus about 1.5 times its tibia in length; dorsum of thorax yellow with brownish gray stripes; head blackish; length 8 mm.
62. c r i s t a t u s

qq Male claspers stout; abdomen gray, segments with pale margins
62a. tentans

pp Male fore tarsi with long hairs; fore metatarsus about one fourth longer than its tibia; abdomen with a tinge of green. (=intermedius)
63. prasinus

Auxiliary key to species of Chironomus (sens. lat.)

This key contains those species of the group Chironomus, the descriptions of which are too brief or imperfect to permit of a place in the foregoing or in the keys which are to follow. With but three exceptions the species contained in it were described by Francis Walker:

a Abdomen dark. Species with brown, gray or black thorax, usually not striped

b Hairy black species, 7.5 mm. long; wings white with fuscous costa; halteres a dirty ochre; Arctic species.....64. polaris Kirby

bb Not as above

c With dark halteres

d Species 5 mm. or more in length; legs dull yellow; hairy; fore feet very long.....65. attenuatus

dd Less than 2 mm. in length

e Length 2 mm.; chest thick; wings white; bare; male
66. crassicollis

ee Length 1 mm.; wings hyaline; hairy?.....67. fimbriatus

cc With pale halteres

d Tibiae and tarsi with black articulations; black species; 4.5 mm. long; abdomen yellow at base; wing with cross band; bare
68. nigritibia

dd Not as above

e Gray species; abdomen black with white rings; length 6 mm.; Arctic species.....69. borealis Curt.

ee Brown species

f Species 6 mm. long. Thorax reddish striped, pleura whitish; abdomen dark brown, incisures paler; wings whitish, bare; male .....70. albistria

ff Species less than 4 mm. in length

g Length 3.5 mm. Thorax brown, gray-striped; halteres yellow; wings hairy? male.....71. brunneus

gg Length 1 mm. Thorax brown; halteres pale brown; wings hairy? .....67. fimbriatus

aa Abdomen usually pale; species with green, pale red or yellow thorax; striped, excepting in a few of the palest

b Abdomen dark brown, or if not, then with black markings or margins on the anterior segments

c Posterior margin of segments black; thorax with broad black stripes; scutellum black; length 5 mm.; male....50. jucundus

cc Abdomen brown with paler margins

d With metathorax black, femora yellow, tarsi dark, wings with the usual spot; hairy? Length 5 mm.; male.....72. lasiopus

dd Not as above

e Thorax reddish, striped, with two white side stripes; pleura hoary; scutellum pale red; legs pale tawny; tips of thighs, shanks, and feet darker; wings bare. Length 6 mm. 70. albistria

ee Thorax testaceous with three brown stripes; pleura pale with dusky spots; abdomen with spots on sides of last two segments; middle and hind tibiae dusky; wings unspotted (see Orthocladius) .....oceanicus Packard

bb Abdomen, basal half at least, yellow or green, no black markings on anterior segments

c Wings with a brown cross band; body straw-colored; length 3 mm.; male (habitat unknown).....73. hilaris

cc Wings without band

d With brownish or reddish abdomen and thorax

e Fuscous species 3.5 mm. long; male; wings hairy? 71. brunneus

ee Abdomen brown with broad, dingy, yellow bands on posterior part of the segments; metathorax black; wings with stigma; hairy? Length 5 mm.....72. lasiopus

dd With yellow or greenish thorax and abdomen

e Species 5 mm. or more in length

f Large species 9 mm. in length, with green thorax; abdomen yellow; wings white; hairy? (See the genus Eurycnemus) .....lasiomerus

ff Species 5 to 6 mm. in length

g Saffron or pale orange-colored species; legs pale yellow; wings hyaline, fringed, hairy? Female. (See the genus Eurycnemus) .....unicolor

gg Thorax silky white with three tawny stripes; abdomen yellow, last two segments dull; legs yellow, a tawny band around each thigh; wings hairy?....74. anticus

ee Species 2.5 mm. or less in length

f General color citron yellow; the thoracic stripes each with a black dot at tip; wing bare? Length 2.25 mm. 75. bimacula

ff Without black dot at tip of each thoracic stripe

g Thorax pale yellowish green, with three dull red stripes; metathorax brown; length 2 mm.; male and female; wings hairy?.....76. confinis

gg General color yellowish green

h Length 1.5 mm.; antennae pale brown; wings deeply fringed; hairy?.....77. pellucidus

hh Length 2 mm.; antennae yellow; male; wings hairy? 78. trichomerus

1. Chironomus brachialis Coquillett.

1901 Chironomus Coquillett. Proc. U. S. Nat. Museum. 23:607
1902 Chironomus ?atrimanus Coq. Proc. Nat. Mus. 25:94

Male. Head black, the face brownish yellow, mouth parts brown, first joint of antennae black, the others yellow, hairs of antennae pale yellow, changing into white at their apices; thorax and scutellum black, polished; abdomen yellow, middle of dorsum of second segment prolonged to the lateral margin at the hind end, on the front end extending entirely around the segment, narrow bases of the three succeeding segments and whole of the following ones, including the genitalia, brown; legs yellow, apex of front femora, front tibiae and their tarsi except the basal two thirds of first joint, knees of other legs, apices of their tibiae, sutures of first three tarsal joints and whole of the two following brown, front tarsi fringed with rather long hairs on outer side of second and third joints; wings bare, basal portion hyaline and with yellow veins, the remainder grayish hyaline and with brownish veins, an indistinct darker brown spot on the small crossvein; halteres yellow. Length 5 mm.

Female. As in the male except that the first antennal joint is yellow, broad humeral region tinged with yellow, second and three following abdominal segments largely brownish (front tarsi wanting), wings with a broad brown cross band which in its outer portion includes the small crossvein. Habitat Westville, N. J.

A male specimen from Ithaca, N. Y., agrees with the above description excepting that the antennal hairs are wholly yellow. In this specimen the thorax when viewed obliquely is faintly pollinose; the last three abdominal segments are flattened; the genitalia rather short; the fore metatarsus is about one fourth longer than its tibia; and the venation as shown on pl.28, fig.1.

2. Chironomus atrimanus Coquillett

1902 Chironomus Coquillett. Proc. U. S. Nat. Mus. 25:94

This may possibly be identical with the preceding.

Female. Head yellowish brown, antennae yellow, the last joint and the mouth parts brown; thorax and scutellum black, highly polished; abdomen somewhat polished, black, the first segment yellow, hind margins of three to six yellowish; legs yellow, front tibiae and their tarsi black, apices of femora, both ends of middle and hind tibiae, apices of joints of their tarsi and whole of the last two joints blackish, front tibiae four fifths as long as the first joint of their tarsi; wings strongly tinged with yellow on the basal third, followed by a wide brown band extending from costa to fifth

vein (cubitus) remainder of wing hyaline; halteres yellow; length 4.5 mm. Kansas City, Missouri.

3. Chironomus varipennis Coquillett

1902 Chironomus Coquillett. Proc. U. S. Nat. Mus. 25:94

Male. Head and body dark brown, a large dull yellowish humeral spot, antennae except the first joint yellow, the hairs gray; thorax opaque, largely gray pruinose, narrow hind margins of abdominal segments gray pruinose; femora brown, the ends narrowly and a band before the apex of each, yellow; front tibiae very short, yellow, the bases brown, other tibiae brown, an indistinct yellowish ring beyond the base; front tarsi wanting, the others yellow; wings whitish, marked with 11 brown spots as follows: Three in a row behind the fifth vein (cubitus), one before middle and another in middle of apical margin of third posterior cell (cell Cu_1) one in base of first posterior (cell R_{4+5}), another in the cell below it, and a third midway between the latter and the base of this cell, one in middle and another in apex of first posterior cell (cell R_{1+5}), also a small one in apex of second posterior cell (cell M); halteres whitish; length, 3 mm. Las Vegas, Hot Springs, N. M.

4. Chironomus octopunctatus Loew

1861 Chironomus Loew. Wiener Ent. Monatschr. 5:33
1878 Chironomus O. S. Cat'l. N. A. Dipt. p.21

Male and female. Pallidly yellow, the tips of femora and tibiae black, wings with four blackish spots. Length 1.2 mm., wing 1.3 mm.

Very pale yellow, legs whitish; posterior part of the thorax shining white and on each side with a darker line. The abdomen fuscous with posterior margin of each segment pale yellow. The tips of the femora rather widely, and of the tibiae rather narrowly, black. Anterior tarsi six times longer than the tibiae. Wings whitish, veins pale yellow; each wing with four blackish spots, in certain lights iridescent; the first is at the anterior fork, the second is between that and the tip of the wing; the other two are at the posterior margin; one of them, composed of two contiguous spots, is situated where the second branch of the cubitus enters the wing margin, the second one midway between this and the base of the wing. Cuba. Translation. Loew, loc. cit.

5. Chironomus scalaenus Schrank

1803 Tipula Schrank. Fauna Boica. 3:73, 2324
1818 Chironomus Meigen. Syst. Beschr. 1:54
1850 Chironomus Zetterstedt. Dipt. Scand. 9:3501
1864 Chironomus Schiner. Fauna Austr. 2:600
1877 Chironomus V. d. Wulp. Dipt. Neerl. 1:266

Head dark brown; the palpi lighter, the antennae yellowish, the antennal hairs of the male pale brown. Thorax and abdomen blackish brown, the thorax sometimes a little lighter with indistinct stripes; the next to the last abdominal segment of the male is broad, the last much smaller; the claspers yellowish, filiform, quite long; the hairs of the abdomen pale yellow. Legs pale yellow; the extreme tip of each tibia with a brown spot; the fore metatarsus is fully twice as long as its tibia; the fore tarsi of the male slightly hairy, yet not bearded. Halteres pale yellow. Wings with a whitish tint and three gray spots which are particularly distinct in the female; one in the anal cell, another in the fork of the cubitus and the last distad of the crossvein. Length 2 to 2.9 mm. Translation. V. d. Wulp. loc. cit.

This fly has been recorded from New Hampshire. About a dozen specimens, male and female, from Ithaca, N. Y. and Washington State agree with the above description excepting in the following particulars: The space separating the two larger spots upon the wing is filled by a very faint cloudiness; the thorax and abdomen are rather brownish in color, the segments of the latter with indistinct paler posterior margins, in some specimens the bases of the femora and the tarsi are slightly infuscated and the fore metatarsus is $1\frac{3}{4}$ instead of twice as long as its tibia. The length also ranged from 1.5 to 2 mm. instead of from 2 to 3 mm. (pl.28, fig.2). As I had no European specimens for comparison I hesitated to pronounce my specimens as distinct species.

6. Chironomus spilopterus Williston

1896 Chironomus Williston. Trans. Ent. Soc. Lond. 273
(Pl.28, fig.3)

Male and female. Face and front yellowish brown. Basal joint of antennae brownish-yellow; flagellum brownish, the plumosity of the male antennae blackish gray. Mesonotum brown or yellowish brown, lightly white dusted; in well preserved specimens brown vittate on the sides, and in front in the middle. Pleura black, in part luteous. Scutellum yellow or yellowish brown. Abdomen black, with yellowish hair; in the male, slender; in the female, broader, and with whitish posterior margins to the segments. Legs yellow, with rather abundant yellow hair; femora in part brown or brownish; front tibiae not more than one half of the length of the front metatarsi. Wings whitish hyaline, with pale blackish spots, which are more distinct when seen obliquely, and situated as follows: One near the base, another near the middle, and a third near or at the tip of the first posterior cell

(cell R_{4+5}); a streak near the middle, and a spot near the tip of the cell in front of the forked cell; a spot on the posterior branch of the furcation, and one or two in the anal angle. Length 1.75 to 2.25 mm. St Vincent Island.

7. Chironomus fascipennis Zetterstedt

1838 Chironomus Zett. Ins. Lappon. 813, 21
1850 Chironomus Zett. Dipt. Scand. 9:3505
1864 Chironomus Schiner. Fauna Austr. 2:599

Male. Wholly pale yellow, not shining; the antennae testaceous, somewhat infuscated, the first joint yellow, the hairs sordidly yellow. The eyes black. The palpi fuscous. The thorax with three yellow stripes; the wings hyaline, with two moderately wide fuscous cross bands, one at the middle of the wing, rather faint, the other a little more distinct at the tip; besides this there is a fuscous spot at the base. Halteres white. The legs pale, somewhat pilose, middle and hind tibae with black tips. Anterior tarsi bare. Length 3.5 mm. New Jersey (Johnson).

8. Chironomus taeniapennis Coquillett

1901 Chironomus Coquillett. Proc. U. S. Nat. Mus. 23:607
1902 Chironomus ?pulchripennis Coquillett. Proc. U. S. Nat. Mus. 25:94

Female. Yellow, tinged in places with green, especially on the abdomen, mouth parts, apical half of the femora, bases of front and middle tibiae and nearly the whole of the hind ones brown, metanotum marked with a transverse pair of triangular brown spots; wings whitish, the costal cell from the humeral crossvein to apex of auxiliary vein (Sc), a cross band extending from the latter point to hind margin of wing where it is greatly dilated, finally the apical fourth of wing, black. Length 4 mm. Massachusetts, New Jersey. Coquillett, loc. cit. Illinois, New York, South Dakota, Pennsylvania.

Upon a comparison of the above description with that of pulchripennis it will be seen that they greatly resemble each other. The examination of a series of Ithaca specimens shows considerable variation in the extent of the dark coloring. To the description I may add that the male does not differ from the female except that the flagella of the antennae are brownish; the genitalia yellow, the lateral arms long, the keel slender, curved, and not much enlarged. In the living specimen the general color is quite green, but upon drying some specimens become almost yellow. The abdominal markings are variable; in some

the last four segments have upon them irregular blotches of brown or black. The posterior end of the lateral thoracic stripes range from a pale yellow in some specimens to a dark brown in others; depending, perhaps, upon their maturity. The amount of black upon the legs is also variable; in an extreme case all the tibiae and the femora except the immediate bases of the latter are black. The fore metatarsus is about one fourth longer than its tibia. Described from numerous specimens (pl.28, fig.4). I have a purchased specimen, collector unknown, bearing the label, C. fascipennis Zett., Riverton, N. J., which is not the latter species but is C. taeniapennis.

9. Chironomus pulchripennis Coquillett

1902 Chironomus Coq. Proc. U. S. Nat. Mus. 25:94

This seems to be a synonym of C. taeniapennis Coq.

Female. Head and antennae yellow, apical half of last joint of the latter and the mouth parts brown; thorax opaque, greenish yellow, mesonotum marked with a pair of lateral brown vittae behind its middle, metanotum with a pair of brown spots which approach each other posteriorly; scutellum and abdomen green, the latter with the hind margins of the segments yellowish, bases of segments six to eight and nearly the whole of the following two brown; legs whitish, the knees black, this color extending nearly to the middle of the middle and hind femora, front tibiae $\frac{4}{5}$ as long as the first joint of their tarsi; wings whitish, the costal cell except its apex brown, a broad brown band crosses the wing, passing over the bases of the first and third posterior cells (cells R_{4+5} and Cu_1) and prolonged along the hind margin nearly to the anal angle, apex of wings broadly brown from the third vein (R_{4+5}) to the upper branch of the fifth (cubitus); halteres white; length 4 mm. Franconia, N. H. Coquillett, loc. cit.

10. Chironomus brunnipes Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3518, 35
1898 Chironomus Lundbeck. Vidensk. Meddel. 273

Black, subshining, thorax of the male the same color, thorax of the female yellow with three black stripes; the antennae and the legs brown; the wings white; the anterior tarsi of the male bare; the metatarsus is a little longer than the tibia; caudal appendages small, short subfiliform. Length 2.7 mm.

Male. Brownish black. Antennae with brown plumosity. Abdomen very narrow, linear, hairy. Caudal appendages short subfiliform, dusky. Wings white, crossvein not clouded; halteres white. Legs brown, tarsi paler, the fore metatarsus is about 1.5

times as long as the tibia, but is twice as long as the second tarsal joint; the remaining joints gradually decreasing in length; legs slender and bare.

Female. Dorsum of thorax yellow with three black stripes. Abdomen rather stout, pubescent. In other respects like the male. Translation. ? Greenland. (Lundbeck.)

11. Chironomus brunneipennis n. sp.

Resembles albimanus Meigen but differs in being slightly larger, in having the knob of the halteres fuscous, and in having the fore metatarsus nearly twice as long as its tibia.

Female. Shining black; legs partly brown. Length 3.5 mm. Head black, proboscis, palpi and antennae fuscous. Thorax including scutellum, metanotum, pleura and pectus shining black; humeri fuscous. Abdomen black, subopaque. Legs brownish; coxae yellowish, femora brown, fore pair yellowish on basal half; tibiae yellowish brown; tarsi brown excepting basal half or two thirds of the metatarsi which are yellowish or brownish yellow. Wings hyaline, very slightly smoky; anterior veins and the crossvein brown, posterior veins yellow. Halteres fuscous, stem yellowish. Ithaca, N. Y.

12. Chironomus caliginosus n. sp.

(Pl.22, fig.5)

Female. Fuscous; legs partly brown; wings smoky. Length 6 mm.

Head, including palpi and proboscis fuscous. Antennae ferruginous, the basal joint and the incisures yellow, apical joint darker. Dorsum of thorax yellow, gray pollinose with three dull black stripes; pleura, sternum, metanotum, and scutellum fuscous. Abdomen fuscous with yellow hairs; posterior margin of segments very slightly grayish; when viewed obliquely from behind the apical half of each segment appears gray pollinose. Fore coxae pale brown, the others fuscous; femora brown; fore femora with basal two thirds and middle femora with basal one half yellow; all tibiae brown; tarsi yellow, tips of the joints brown; fore metatarsus 1.5 times as long as its tibia. Wings smoky, especially along the course of the veins; veins reddish brown including crossvein. Halteres white, with end of knob brown. Two specimens. Ithaca, N. Y.

13. Chironomus niveipennis Fabricius

1805 Chironomus Fabr. Syst. Antl. 42, 21
1818 Chironomus Meigen. Syst. Beschreib. 1:51, 73
1850 Chironomus Zett. Dipt. Scand. 9:3566, 92

1864 Chironomus Schiner. Fauna Austr. 2:598
1877 Chironomus V. d. Wulp. Dipt. Neerl. 269, 40
1895 Chironomus Johnson. Proc. Acad. Nat. Sc. Phil. 320
1838 Chironomus obscurus Zett. Ins. Lappon. 815, 31
1830 Chironomus pilicornis Meigen. (nec. Fabr.). Syst. Beschr. 6:254
1838 Chironomus rudis Zett. Ins. Lappon. 809, 3

Larva and pupa. Miall and Hammond (1900) state that the larva inhabits a tube and that it possesses red blood. There are no ventral blood gills. The pupa has a tail fin composed of thirty or forty long setae, and the abdominal segments are laterally expanded. On the second abdominal segment are paired posterolateral transparent appendages of small size, enclosing blood spaces. There are two conical prominences, each bearing a long seta, on the vertex of the head. The tracheal gill divides into three primary branches as usual. The secondary branches are comparatively few; each encloses a number of tracheae which pass to the ultimate branches.

Imago, male. Black; dorsum of the thorax dark gray, with three black longitudinal stripes, scutellum sometimes brown; abdomen black, at the incisures a little more gray, the last few segments somewhat wider and flattened (as with the males generally), hairs dark, the forceps short and black, the arms slender. Head, antennae and palpi black. Legs black, the tibiae and the tarsi often brownish, the fore tarsi of the male densely bearded with brown hairs; the metatarsus a little longer than the tibia. Wings whitish, the anterior veins more distinct, the crossvein black. Halteres dark. The female does not have the bearded fore tarsi and her halteres are often sordidly white. Length 6 to 7 mm. Schiner, loc. cit.

Florida (Johnson). Some specimens from South Dakota which I identify as this species have both anterior and posterior margin of each abdominal segment grayish, the posterior most distinct; the fore tarsi of the male long but rather sparsely haired, and the fore metatarsus about one-eighth longer than its tibia; the second, third, fourth and fifth fore tarsal joints gradually decreasing in length.

14. Chironomus hyperboreus Staeger

1845 Chironomus Staeger. Kröjer: Naturh. Tidsskr. n. s. 1:349
1878 Chironomus Osten Sacken. Cat'l. N. A. Dipt. 20
1898 Chironomus Lundbeck. Videnskab. Meddel. 272, 49
1865 Chironomus polaris Bohem. Ofv. K. Vet. Akad. Förh. 574, 18

Blackish, thorax grayish, with three black stripes, abdomen black, with narrow whitish fasciae, wings white with a black spot. Length 7 to 8 mm.

Male. Legs black, the anterior tarsi densely bearded.

Female. Legs fuscous-brown, fore femora testaceous at the base.

"The plumes of the male antennae are black, the abdomen is black, that of the female nearly coal-black, with narrow, sharply marked whitish posterior margins of the segments. The legs are black, those of the female more brownish, the fore femora with a somewhat yellowish base. . . . The fourth tarsal joint of the fore legs is about three quarters the length of the third. The male fore tarsi are densely bearded." Greenland. Staeger, loc. cit.

The male specimens with bare fore tarsi described by Staeger (loc. cit.) as varieties from Greenland, have been separated by Lundbeck (1898) as a distinct species under the name of C. staegeri (q. v.)

15. Chironomus staegeri Lundbeck

1898 Chironomus Lundbeck. Vidensk. Meddel. 271, 48
1838 Chironomus annularis Zett. Ins. Lappon. 809, 2
1845 Chironomus hyperboreus Staeger. Kröjer: Natur. Tidsskr. n. s. 1:349
1869 Chironomus Holmgr. K. Svensk. Vet. Ak. Handl. 8:46

This name was given by Lundbeck to those specimens which Staeger (loc. cit.) considered a variety of C. hyperboreus differing from the type in having the anterior tarsi of the male bare.

Male. Antennae nearly as long as the thorax, fuscous black, densely plumose, palpi black. Thorax black, scarcely shining, cinereous puinose; the mesothorax with short hairs, the usual three stripes more or less distinct; the scutellum elevated, bristly. The abdomen fuscous black, pale haired, the apical margin of each segment hoary or cinereous, the caudal appendages narrow and bristly. The wings narrow, cinereous, whitish or lightly smoky tinted, toward the costal margin a little darker; anterior veins strong and dark, the others pale and translucent; the radial veins straight, toward the tip nearly parallel with the media; the subcostal vein slightly curved, the peduncle of the cubitus extends but very little distad of the tip of the basal cell, the branches slightly curved. Halteres dirty white, the tip of the knob and the base of the peduncle often darker. Legs fuscous black, the middle and hind pairs rather long-haired, the fore tibiae and tarsi thinly and shortly haired, fore metatarsus one fourth longer than its tibia.

Female. Similar to the male but the dorsal thoracic stripes are more distinct, apical margins of abdominal segments more widely cinereous or sometimes pale gray; the radial veins lightly curved at the tip; the legs sometimes dilutely black fuscous, sometimes paler. Length 6.5 to 7.5 mm. Greenland. Holmgren (loc. cit).

16. Chironomus flavicingula Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:20
1878 Chironomus Ost. Sack. Catal. Dipt. N. A. p.20
(Pl.28, fig.6, and pl.32, fig.7)

The blood-red larvae of about 12 mm. length were dredged from the sand in the bottom of a shallow pond near Ithaca N. Y.

Larva. (Pl.21, figs. 13 to 19.) Head dark brown; antennae short; labrum with about ten pairs of pale setae, two or three pairs of which are quite short (fig.15, under surface fig.14); at extreme apex with a pair of fan-like appendages (f), which hang downwards, though shown in the figure folded out in a horizontal plane; caudad of this there is a comb with long, fine, caudad projecting teeth. The epipharynx (fig.13) with three cephalad projecting fan-like organs (f^1) forming the "posterior comb," five or six lateral setae (s), several pairs of ventrad projecting curved and branched setae (s); caudad of these is an arched chitinized piece (fig.13b); laterad of this are the dark brown, chitinized, caudad and ventrad curved lateral arms not shown in the figure. The black tipped mandibles are as usual, with the mesad projecting branched hairs, and two laterad projecting setae; each maxilla (fig.19mx) has prominent palpus, a large seta and numerous papillae on the mesal margin, a pair of large setae at the base of the palpus, another pair (not shown in figure) at base of the mandible. The hypopharynx (fig.19hy) has a rounded apical margin with numerous short hairs and papillae. The labium (fig.18 and fig.19 l) has a broad, blunt, central tooth and six small laterals on each side. There are two long setae upon each side of the head below the eyes. The fore feet are short, with very numerous, short, curved, yellow setae. The body seems to be entirely devoid of hairs. Each posterior foot is provided with a number of bilobed brown claws. The dorsocaudal papillae of the last segment are about as long as wide, with 6 or 7 long setae at the tip, and one or two short ones on the side; caudad of these and immediately above the upper pair of blood gills are two more long setae. The blood gills of the eleventh segment are present; those of the twelfth are nearly as long as the posterior feet; slightly conical and four in number.

Pupae. The pupa is dusky in color when nearly mature, showing the colors of the imago. The respiratory filaments are white,

conspicuous in the living specimen and much branched, the setae markings upon the dorsum of each abdominal segment as is shown in fig.16; the seventh and eighth segments are entirely without, and the sixth usually has but few, setae. The posterior margin of the second has the usual black longitudinally ridged fascia. The lateral fin of the eighth segment, together with the terminal spur, are shown in fig.17. The caudal paddle is fringed with long, pale, delicate, matted hairs.

Imago, male. Body gray, with two large white spots on each side of the chest; abdomen fringed with hairs on each side, and having a white silvery band on the hind border of each segment; feelers black; legs black, hairy, a yellow ring near the tip of each thigh, and two yellow rings round each shank; feet dull yellow towards the base; wings colorless, with the usual dark spot on each; veins pale brown; poisers gray. Length of body 5.5 mm., of the wings, 10 mm. St Martin's falls, Albany river, Hudson bay. Walker, loc. cit.

At the head of the division to which this species belongs, Walker states that the wings are hairy. This, however, is evidently an error. To the above description the following may be added.

Male. Head and occiput black, proboscis and palpi dull black, the former with dark brown hairs. Antennae brownish yellow, the large basal joint black, the hairs dark brown. Thorax wholly black, the dorsum and the scutellum with cinereous bloom, the former with three cinereous stripes, the middle one divided by a fine black line, the hairs pale brown. Abdomen velvet black, the posterior margin of each segment dorsally with a moderately wide white fascia extending to lateral margins. When viewed from behind, the last three or four segments appear to me mottled with cinereous, leaving a black median line on the fifth and sixth segments. Venter dull black; genitalia brownish yellow, moderately long (pl.32, fig.7). Abdomen sparsely covered with long, nearly erect, yellowish hairs. Coxae brownish black, moderately shining; femora brown, excepting the yellow basal articulation and a yellow subapical ring; tibiae cream white, with brown base and tip; the brown of the front pair quite pale, the hind pair having in addition a median ring which is sometimes indistinct. In some specimens the basal half of fore tibiae is also brown. Tarsi cream white, the tips of all joints and the whole of the fifth brown, the brown of the fore pair being quite pale. The anterior tarsi are delicately bearded. The anterior metatarsus about one fifth longer than its tibia. Wings hyaline, crossvein dark brown; venation as figured. Halteres brownish yellow with apical half of the knob dark brown.

Female. Like the male, excepting in the following particulars: Tips of antennal joints reddish brown, the hairs pale; thorax with a little more cinereous coloring, the hairs upon the abdomen a little shorter; fore tarsi bare. Described from a number of specimens. Ithaca, N. Y., Kansas.

17. Chironomus halteralis Coquillett

1901 Chironomus Coq. Ent. News. p.17
(Pl.28, fig.7)

Head black, palpi and antennae yellowish brown, plumosity of male antennae dark gray; thorax dark brown, the anterior end tinged with yellow, a pair of broad, gray pruinose vittae on the posterior half of the mesonotum, the hairs light yellow; scutellum dark yellow; abdomen black, slightly polished, thinly covered with rather long yellow hairs; femora, tibiae and tarsi yellow, bases of femora slightly tinged with brown; front tarsi slender, almost as long as the body, destitute of hairs, the first joint about twice as long as the front tibia; middle and hind tibiae and their tarsi in the male, thickly covered with rather long yellow hairs, much sparser in the female; halteres pale yellow, the knobs black; wings bare, hyaline, the apical half slightly darker, veins in the basal half yellow, in the apical half more brownish; length 2 to 3 mm. Washington, D. C. Coquillett loc. cit.

A number of specimens from Ithaca, N. Y., agree with this description.

18. Chironomus nitidellus Coquillett

1901 Chironomus Coq. Proc. U. S. Nat. Mus. 23:608

Male. Head black, mouth parts yellow, antennae, except the basal joint, yellow, the hairs whitish; body black, polished, the first two abdominal segments and the claspers yellow; legs yellow, the femora except their bases, front tibiae wholly, and apices of hind ones brown, front tarsi bare; wings bare, whitish hyaline, the veins brown, halteres yellow; length, 2.5 mm. Riverton, N. J. Coquillett loc. cit.

19. Chironomus fallax n.sp.

(Pl.28, fig.8)

Female. Black; first abdominal segment yellow or greenish; legs partly black. Length, 3.5 mm.

Head, including proboscis, palpi and antennae yellowish, the basal joint of the latter somewhat brownish. Thorax cinereous black, with three broad shining black stripes, more distinct when viewed obliquely. Pectus, pleura, and scutellum brown, the

last sometimes paler. Abdomen fuscous, the first segment yellowish-green, in living specimens bright green; the remaining segments more or less distinctly marked with sordidly yellow hind margins; hairs pale brown or yellowish. Fore coxae brown, middle and hind pairs yellow. Legs cream white, the fore femora excepting their bases and tips dark brown; tips of middle and hind tibiae each with minute black comb; pulvilli present, empodium pectinate. Fore metatarsus about 1.4 times as long as its tibia. Wings hyaline with a milky tinge; veins slightly yellowish; venation as shown in figure; halteres yellowish. Ithaca, N. Y.

20. Chironomus riparius Meigen

1804 Chironomus Meigen. Klass. 1:16, 3
1818 Chironomus Meigen. Syst. Beschr. 1:23, 6
1850 Chironomus Zett. Dipt. Scand. 9:3489, 7
1864 Chironomus Schiner. Fauna Austr. 2:603
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.253, 8
1895 Chironomus Johnson. Proc. Acad. Nat. Sc. Phil. 320
1898 Chironomus Lundb. Vidensk. Meddel. p.272, 50
1826 Chironomus annularis Macq. Recueil Soc. Sc. Agri. Lille. p.194, 2
1826 Chironomus viridipes Macq. Recueil Soc. Agri. Lille. 195, 4
1838 Chironomus zonulus Zett. Ins. Lappon. p.810, 7

(Pl.28, fig.9)

Male and female. Dorsum of the thorax, especially in front of the scutellum, light gray, with three black longitudinal stripes, the median one divided by a fine line, abbreviated posteriorly though continued to the scutellum by a black line; the lateral stripes abbreviated anteriorly; scutellum gray or grayish yellow; the metanotum gray. Abdomen black, the posterior margins of the segments sometimes with wide, sometimes more narrow whitish bands; the posterior segments gray; forceps small. The antennae brown, the hairs of the same color; the palpi darkened. Legs brownish, yellow or pale yellow, the femora sometimes with a greenish tinge, the articulations dusky; the fore tarsi of the male not hairy; the metatarsus 1.5 times longer than the tibia; the second tarsal joint one half as long as the metatarsus but longer than the third; third and fourth about equal in length. Wings whitish, with a small brown spot. Halteres yellowish. The antennae of the female are yellow at the base. Some specimens have the humeri yellowish or greenish, but these may be distinguished from nearly related forms by their slender fore tarsi. Length 6.75 to 9 mm. Translation in part from Schiner, loc. cit.

According to V. d. Wulp, loc. cit., and Weyenbergh (1874) the larvae are transparent and pale green; some larvae from which I bred this species resemble C. decorus n. sp. in the form of the labium as well as in other details. Ithaca, N. Y.; Idaho; Washington State; Pennsylvania; South Dakota; Minnesota; New Jersey; Douglas, Alaska.

21. Chironomus barbipes Staeger

1839 Chironomus Staeger. Kröjer: Naturh. Tidsskr. 2:561, 5
1850 Chironomus Zett. Dipt. Scand. 9:3486, 5
1864 Chironomus Schiner. Fauna Austr. 2:601
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.252, 6

(Pl.28, fig.10)

Male. Hairy, blackish species with hyaline wings having the anterior veins somewhat reddish; halteres sordidly yellow, the extreme tips a little darker; the second joint of the fore tarsus shorter than the third. Length 8 mm.

Head and basal joint of antenna dull black, the flagellum of the latter and the palpi fuscous. Antennal hairs dark reddish brown. Thorax cinereous, with three faintly marked wide cinereous black stripes; scutellum, pectus, pleura and metanotum cinereous. Abdomen black, the posterior margins of the segments cinereous, covered with long brown erect hairs. Genitalia brown, the claspers rather short and stout, the dorsal keel of moderate size. The coxae cinereous; the legs testaceous, the bases of the femora, the knees, the tips of the tibiae, and the middle and hind tarsi a little darker, the fore tarsi except basal half of metatarsus brown and densely bearded with long brown hairs. The fore femora and tibiae and basal half of metatarsi nearly bare; the whole of the middle and hind legs quite hairy. Fore metatarsus about one sixth longer than its tibia; the *second tarsal joint shorter than the third.* The wings narrow and long, hyaline with very slight yellow tinge; the costa, radius, R–M crossvein and the basal half of the media testaceous, the other veins hyaline; venation as figured. Halteres yellowish.

Female. Basal half of antennae yellowish, fore tarsi bare. Readily distinguished from related species by its short second tarsal joint.

Van der Wulp (1877, p.252), suggests that this may possibly be a synonym of C. pallens Meigen.

Two male specimens, Chicago, Ill., May, 1899.

22. Chironomus annularis Degeer

1776 Tipula Degeer. Mem. pour serv. a l'hist. d. Ins. 6:379, 18
1809 Chironomus Latr. Gen. Crust. et Ins. 4:250
1818 Chironomus Meigen. Syst. Beschr. 1:21, 3

1850 Chironomus Zett. Dipt. Scand. 9:3485, 4
1864 Chironomus Schiner. Fauna Austr. 2:602
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.253, 7
1804 Chironomus annulatus Meigen. Klass. 1:12, 2
1818 Chironomus pallens Meigen. Syst. Beschr. 1:22, 5
1818 Chironomus tristis Meigen. Syst. Beschr. 1:48, 62

This species resembles riparius but differs in having the posterior margins of the abdominal segments grayish, not sharply separated from, but blended into, the black; and in having the third and fourth tarsal joints of the fore legs subequal in length.

Male. Head and antennae blackish, palpi and proboscis fuscous. Dorsum of the thorax cinereous with three dull, black stripes; metanotum, pleura, and sternum dull black, slightly pruinose; scutellum fuscous. Abdomen fuscous or black, the posterior margins of the segments grayish, the hairs yellowish, genitalia small, black. Coxae blackish; legs subfuscous, tarsi slightly darker. Fore metatarsus about one fifth longer than the tibia, the third and fourth tarsal joints about equal in length, the fore tarsi and the middle and hind legs long-haired. The wings hyaline, the anterior veins dark, particularly the crossvein. The venation as figured (pl.28, fig.11). Halteres whitish. Length 7 to 8 mm.

Female. Like the male but the anterior tarsi are bare, and in the single specimen the tips of the femora are darkened. Ithaca, N. Y. A darker variety (var. tristis Meig.) with slightly infuscated halteres from Washington State.

I have compared my specimens with specimens from Europe and can detect no differences.

23. Chironomus dispar Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:247, 85
1850 Chironomus Zett. Dipt. Scand. 9:3506, 22
1864 Chironomus Schiner. Fauna Austr. 2:604
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.257, 13
1838 Chironomus lucidus Zett. Ins. Lappon. p.810, 5
1850 Chironomus Zett. Dipt. Scand. 9:3509, 25

Shining black; the abdomen somewhat brownish, with paler hairs and occasionally reddish yellow lateral spots; the anal segment narrower and shorter than the preceding segment; the forceps strong, its arms nearly as long as the last abdominal segment. Head black, the palpi brown, the antenna together with its hairs blackish. The legs yellow, the coxae brown; the tibiae brown at the tip, fore tarsi delicately ciliate, the metatarsus one half longer than its tibia. Wings whitish. The crossvein not

darkened. The female has yellow antennae, the abdomen is without spots, and the legs are of a more pronounced whitish yellow. Length, 7 mm. Translation in part from Schiner. New Jersey. (Johnson.)

24. Chironomus albimanus Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:40, 45
1850 Chironomus Zett. Dipt. Scand. 9:3551, 77
1864 Chironomus Schiner. Fauna Austr. 2:604
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.268, 38
1804 Chironomus annularis Meigen. Klass. 1:17, 16

Male. Head black, proboscis, palpi and antennae sordidly yellow, basal joint of the last black; antennal hairs brownish. Dorsum of the thorax shining black, sometimes with faint indications of three fine cinereous lines; scutellum, metanotum, pleura and pectus shining black. In immature specimens the thorax is more brownish and the stripes are wider. Abdomen shining black; the anterior segments fuscous; the hairs and the genitalia yellowish, the claspers of the latter slender and short; coxae shining brown or black; legs pale yellowish, apical one half or two thirds of all the femora, the whole of the fore tibiae and the extreme tips of the middle and hind ones black or deep brown; each fore tarsus with its first joint whitish, the others slightly infuscated; anterior legs bare; fore metatarsus $1\frac{1}{3}$ times as long as its tibia. Wings hyaline with a slightly smoky tinge; veins including crossvein yellowish and distinct; venation as figured (pl.28, figs. 12, 13). Halteres whitish. Length 4 mm.

Female. Like the male, but the abdomen is nearly wholly shining black in matured specimens and the veins of the wings seem a little darker. Length 3 mm. Ithaca, N. Y. The American agree perfectly with my European specimens.

25. Chironomus tenellus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.812, 15
1850 Chironomus Zett. Dipt. Scand. 9:3517, 34
(Pl.21, figs. 1 to 4)

Larva. The larva is pale red, 4 to 5 mm. in length. Head brown, about 1.5 times as long as wide, with a few small dorsal setae. Antenna (fig.4) short, about three fourths as long as the mandibles, the basal segment being three fifths of the total length. The labrum (fig.1 ulr.) has upon its lower surface the normal three pairs of large setae and three pairs of smaller ones. The epipharynx (fig.1) has the usual lateral arms (la) with the dark colored extremities, the transverse comb with 5 or 6 blunt, rather indistinct teeth, and the stout curved pectinate hairs. The mandible (fig.1 md) is stout, with blackened teeth, a longitudinal

row of hairs on the dorsal side (not shown in the figure) overhanging the teeth, a long prominent seta on its lateral surface, and a few long much branched setae on the dorsal surface of the mesal margin. The maxilla (fig.1 mx) has a short stout palpus, a few short setae and papillae and a group of delicate mesad projecting filaments. The labium (fig.1 l) has a black margin, the middle tooth is rounded, the second laterals are small and closely united to the first laterals. The anterior and posterior prolegs are as usual with the species of Chironomus, the claws of the posterior pair are bilobed; caudad of the anal papillae with their tufts of setae, is a conspicuous pair of spines or bristles. The papillae mentioned above are somewhat infuscated at the tip. The anal blood gills are present, though none were discovered on the ventral surface of the eleventh segment.

Pupa. The pupa is brownish, about 4 mm. in length. The two respiratory organs, each composed of numerous white filaments, are conspicuous. The abdominal segments have the microscopic spines covering nearly the whole dorsal surface (fig.3). There are two patches near the anterior margin of each segment, a large discal patch of slightly larger spines, and posterior transverse rows of still larger blunt ones. Between these patches and gradually merging into them are numerous smaller spines. Thus the entire surface is practically covered with microscopic spines of varying sizes, the anterior patches more distinctly separated from the remainder. The lateral fins of the eighth abdominal segment each has the usual four lateral filaments, and terminates in a slightly sinuous spur (fig.2). The caudal fin has the usual fringe of pale matted filaments.

Imago, male and female. Shining black; thorax of the male the same color, that of the female paler with three brown stripes. Antennae yellow, the antennal hairs of the male the same color; palpi yellowish; sternum schistaceous. Abdomen of the male slender, pilose, black, the first and second segments wholly, and the posterior margins of the third, fourth and fifth fuscous, the last three segments, widened and somewhat dilated; genitalia small, resembling those shown on pl.32, fig.8; the inferior lobes with curved setae; the superior lobes in this species are much shorter and without peduncle, pale in color; abdomen of the female stouter, black, paler at the base, pubescent. Wings white, with pale veins, spotless. Halteres white. Legs with the coxae pale yellow, or white, spotless, the middle and hind legs pale haired; the fore legs bare; the fore metatarsus over 1½ times as long as the tibia, and twice as long as the second tarsal joint. The thorax of the female is sometimes wholly brown. Length 3.5 mm. Translation in part from Zetterstedt, loc. cit.

A specimen from New Jersey is doubtfully referred to as this species by Johnson in Smith's catalogue of the insects of New Jersey. Several bred specimens from Ithaca, N. Y.

26. Chironomus chloris Meigen

1818 Chironomus. Syst. Beschr. 1:28, 17
1850 Chironomus Zett. Dipt. Scand. 9:3511, 27
1864 Chironomus Schiner. Fauna Austr. 2:604
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.256, 12

Length 5.5 to 7.5 mm. Head blackish, antennae and palpi dark brown; antennal hairs in the male brown; paler toward the tip. Thorax shining, blackish green, with black longitudinal stripes, the ground color usually so dark that the thorax appears wholly shining black, as do also the scutellum, metanotum, pectus and pleura; the pectus with light gray pruinose appearance. Abdomen olive green, black toward the caudal end; the anal segment of the male half as long as the preceding segment; the claspers small, slightly broadened at the middle; the hair of the abdomen grayish; after death the abdomen usually becomes wholly black. Legs brownish yellow; the femora, at least the knees, the tips of the tibiae and tarsal joints dark brown, the last tarsal joint wholly darkened; fore metatarsus 1.5 times as long as its tibia; fore tarsi of the male somewhat hairy but not bearded, the posterior legs of both sexes delicately ciliate. Halteres pale yellow, the knobs slightly darkened. The wings when held against the light appear brownish yellow, when held over a dark surface they appear whitish; the veins very pale brown; crossvein not darkened. Translation from V. d. Wulp. loc. cit.

The female has a yellow dorsum of thorax with three black stripes, the scutellum is yellow, and the abdomen sometimes has narrow whitish incisures.

According to V. d. Wulp (1868) this European species also occurs in the United States. Weyenbergh (1874, p.151) says that the larva is almost colorless, and is found upon weeds hanging into the water.

27. Chironomus devinctus Say

1829 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 6:150
1859 Chironomus Say. Compl. Wr. 2:349
1878 Chironomus Ost. Sack. Cat'l, Dipt. N. A. p.20

(Pl.28, fig.14)

Tergum black, incisures white; feet with black incisures; body dusky; stethidium dusky livid; thorax trilineate and blackish; scutel dull honey yellow, halteres and wings white; tergum brown-

ish black, incisures, particularly those near the base, white; thighs black, anterior (fore pair) pale at base; the others with a white annulus near the tip; tibiae and tarsi white, with black incisures. Length nearly 5 mm. Inhabits Indiana.

Some Ithaca specimens, both male and female, agreeing with above description may be more fully characterized as follows: The entire insect has the appearance of being black, and greatly resembles C. flavicingula Walker, differing in having white halteres and an unclouded crossvein. The thorax may be described as being wholly blackish with cinereous lines between the usual three black dorsal stripes; scutellum pale brownish. The narrow white posterior margins of the abdominal segments are very distinct and sharply defined. The fore metatarsus is more than 1¼ times as long as its tibia. My single male specimen has lost its fore tarsi. The wings are hyaline, all the veins, including the crossvein, pale. Ithaca, N. Y.

28. Chironomus californicus n. sp.

Male. Head yellowish brown, antennae with the hairs dull yellowish brown, large basal joint blackish; palpi dusky. Thorax opaque, bare, cinereous with three dull grayish or blackish dorsal vittae; humeri more or less yellowish; pleura and pectus gray or blackish; scutellum yellowish or pale brown; metanotum dull black. Abdomen linear, slender, gray haired, lusterless black, apical margin of each segment pale green or yellowish; the last three segments slightly wider, depressed. The genitalia fuscous, short and filiform. Wings white, the crossvein not darkened. The wing surface does not appear uniformly white, but the narrow space on each side of the veins is less purely white by reflected light. Halteres white. Legs white; the coxae grayish; the base and tip of each femur and of each tibia brownish or blackish; the tarsal joints somewhat infuscated. The middle and hind legs pale haired, the fore pair only pubescent; the fore metatarsus about two thirds longer than its tibia; the second tarsal joint about half as long as the metatarsus, the third and fourth but slightly shorter than the second. This species resembles C. niveipes Zett. but differs in the coloring of the legs. Length 5 to 6 mm. Pasadena, California.

29. Chironomus palliatus Coquillett

1902 Chironomus Coq. Proc. U. S. Nat. Mus. 25:95

Male and female. Head, mouth parts, and first joint of antennae dark brown, remainder of antennae livid, the hairs gray; thorax

dark brown, mesonotum opaque, a broad, yellowish median vitta on the anterior half, and a widely separated pair of gray pruinose vittae on the posterior half; abdomen opaque, velvet-black, its hairs yellow; legs yellowish white, front and middle femora, except their apices, also bases of hind femora brownish, middle tibiae tinged with brown, front tarsi only pubescent, front tibiae three fourths as long as their first tarsal joint, hind tibiae and their tarsi in the male densely clothed with rather long hairs; wings hyaline, slightly tinged with yellow, small crossvein not darker than the adjacent veins, third vein (R_{4+5}) almost straight; halteres whitish; length 2.5 to 4 mm. Washington, D. C. Coquillett, loc. cit.

30. Chironomus pedellus Degeer

1776 Tipula Deg. Mem. pour serv. a l'hist. d. Ins. 6:378, 17
1818 Chironomus Meigen. Syst. Beschr. 1:28, 16
1850 Chironomus Zett. Dipt. Scand. 9:3535, 57
1864 Chironomus Schiner. Fauna Austr. 2:606
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.259, 19
1794 Tipula cantans Fabr. Ent. Syst. 4:247, 67
1804 Chironomus Meigen. Klass. 1:13, 7
1805 Chironomus Fabr. Syst. Antl. p.45, 34
1803 Tipula littoralis Schrnk. Fauna Boica. 3:74, 2325
1880 Chironomus var. atricornis Strobl. Progr. Gymn. Seltenstetten. p.53

Male. Dorsum of the thorax shining black; the humeri with ferruginous or yellowish-green spots, which seem to be the remains of the original ground color; the scutellum and the metanotum also black. The abdomen a beautiful, bright green which becomes paler or more yellowish in dried specimens. The posterior segments flattened, black, or blackish-brown; the forceps quite small and slender. Head and palpi brownish; the antennae brown, its hairs lighter, the basal joint yellow. Legs pale yellowish, in life somewhat greenish; the coxae, the fore knees broadly, the middle and hind knees narrowly brown banded, the tips of the tibiae and the tips of the tarsal joints brownish; the femora and the tibiae of the fore legs of equal length; the fore metatarsus about one fourth longer than its tibiae, and not bearded. Wings whitish, with pale veins; venation as shown on pl.28, fig.16; the halteres pale.

Female. The female has yellow antennae with only black tips; and the humeral spots are more spread out, appearing to crowd the black dorsal patch into longitudinal stripes. Length 5.5 to 6 mm. Wisconsin (V. d. Wulp); New Jersey (Johnson). Several male specimens from Ithaca, N. Y.

31. Chironomus pedestris Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:246, 81
1850 Chironomus Zett. Dipt. Scand. 9:3537, 58
1864 Chironomus Schiner. Fauna Austr. 2:606

Resembles C. pedellus, but the extreme tips of the tibiae are black, the fore femora are entirely black with the exception of the base; and the tips of the knobs of the halteres are black. Length 5.5 to 6 mm. Schiner loc. cit.

Green, shining, thorax and tip of abdomen, black; dorsum of thorax of the male with three wide confluent black stripes; antennae of the male pale brown; wings white; tip of the knob of the halteres blackish; legs pale, the extreme tips of the tibiae, the whole of the fore femora except the yellowish bases are black; the anterior tarsi of the male nearly bare, fore metatarsus about one fourth longer than its tibiae; the male claspers short and slender. The first five abdominal segments in the dried specimens are pale yellow. Everything else as with C. pedellus Zetterstedt. New Jersey (Johnson).

32. Chironomus nigricans n. sp.

(Pl.21, figs. 5 to 12, and pl.28, fig.15)

Larva. The larvae were collected from the ponds in the vicinity of Cayuga lake, Ithaca, N. Y. They are blood-red, slender, about 12 mm. long, head short, pale brown, edge of the labium and tip of the mandibles black, each eye consisting of a pair of distinctly separated spots, one of these spots being again divided by a fine line. The antennae is slender, about three fourths as long as the mandible, its first joint five sevenths as long as the others taken together (fig.5). The labrum is of the usual form, with about five pairs of curved subapical setae, and a pair of flattened, ventrad-projecting fan-like processes. The epipharynx (fig.10) has a pair of curved, transverse, toothed ridges, a transverse comb (c) composed of five leaf-like parts, each part with four or five pointed lobes. The lateral arms, not shown in the figure, are of the usual form, each having a bilobed extremity, the outer lobe being slender and pointed, the inner one shorter and broader. The three pairs of pectinate setae which are placed within the horseshoe-shaped ridge are conspicuous (fig.10). The mandibles are stout, with black apices, the usual subapical hairs, mesad projecting branched setae, and a pair of slender lateral projecting setae (fig.7). The maxilla has a moderately stout palpus with a slender apical seta, several stout pale setae, some fine hairs near its base, several mesad projecting pointed lobes, and a number of scattered papillae

(fig.6). Upon the hypopharynx (hy) is a pair of slender branched processes besides the usual hairs and papillae. The middle pair of the teeth in labium (fig.6 l) are the longest, and the second, third and fifth laterals are longer than the first, fourth and sixth. The setae of the anterior prolegs are pale brown, and rather coarser and more distinct than those of most of the Chironomid larvae (fig.8). The posterior prolegs have the usual bilobed claws of which the two lobes of each marginal claw make a smaller angle with each other than do the central claws (fig.9). Immediately dorsad of the four short and thick anal blood gills is a pair of small setae; the basal nodule upon which each dorso-anal tuft of setae is placed is quite small, about as wide as it is long. The ventral blood gills of the eleventh abdominal segment were not seen in this specimen.

Pupa. (Figs. 11 and 12.) The pupa is greenish brown, about 6 mm. in length, with the usual pair of white thoracic respiratory tufts. The dorsum of the second and third abdominal segments are marked as shown in fig.11. Near the anterior margin of each of segments four, five and six is a transverse row of short but conspicuous dark spines. The epidermis at the base of each spine is brown; the entire dorsal surface of the segment behind this row is microscopically punctate with extremely short spines. Near the posterior margin these spines become somewhat larger, forming an irregular double or triple transverse row. Second segment is like the following segments, but has in addition the usual transverse row of longitudinal ridges on its posterior margin. All these segments have a few pale setae arranged as shown in the figure. The seventh and eighth segments are nearly devoid of markings, though they have a few small setae. The lateral fins of the eighth segment each has the usual lateral filaments, and each ends in a chitinous comb of five teeth (fig.12). The caudal fin has the usual fringe of matted hairs.

Imago. (Pl.28, fig.15.) Male and female, blackish; legs white, male with whitish abdomen. Length 4 to 5 mm.

Male. Head, including palpi, proboscis, antennae and its hairs pale fuscous. Dorsum of the thorax dark brown with three subshining broad blackish stripes, metanotum and pectus blackish; pleura and scutellum a little paler. The hairs of the mesothorax and scutellum yellow. Abdomen white with a greenish tinge, the last three joints including the genitalia sometimes pale fuscous, and occasionally the posterior margins of segments very narrowly darkened. The claspers elongate, the inferior lobes slender and slightly clubbed. Hairs pale. Legs white, the tips of the middle and hind tibiae each with a minute black circular comb with two of its teeth slightly elongated into spurs. Fore tarsi of male,

bare. Wings white with a slight milky tinge; veins colorless, including the crossvein; venation as figured. Halteres white, sometimes with a slight greenish tinge. In an occasional specimen the middle section of each fore femur is brownish.

Female. Like the male, excepting that the abdomen is black or deep fuscous, dull; in well-preserved specimens the posterior margins slightly cinereous; hairs pale. The flagella of the antennae and sometimes the palpi also yellowish. In both sexes the fore metatarsus is about one third longer than its tibia. One bred specimen and a number of captured ones from Ithaca, N. Y.; also some from New Jersey.

33. Chironomus aberrans n. sp.

Female. Resembles C. f a l l a x n. sp. but is paler. Length 3.5 mm. Head, including antennae, wholly yellow, palpi pale fuscous. Dorsum of the thorax and scutellum yellowish, the three dorsal stripes, pectus and a mark on the pleura, brownish; metanotum dark brown. Abdomen fuscous, the first two and the basal part of the third greenish or yellowish; posterior margins of the other segments indistinctly paler fuscous; hairs pale. Coxae, the knees, the tips of the middle and hind tibiae and of the tarsal joints brown; the apical half of front femora, basal half and the tips of the front tibiae, and the tips of the fore tarsal joints dark brown. Wings hyaline, with a milky tinge; the veins, including the crossvein, yellow; venation as shown on pl.28, fig.17. Halteres white. The fore metatarsus is about one fifth longer than its tibia.

Male. Like the female but differs in having the first four or five abdominal segments, yellowish. Ithaca, N. Y., Pennsylvania, Washington State, New Jersey.

34. Chironomus lugubris Williston

1896 C h i r o n o m u s Williston. Trans. Ent. Soc. Lond. p.274

Male. Similar to C. l o n g i m a n u s (No. 51), but differs in lacking the brown stripes of the mesonotum, which is uniformly light yellow, in the abdomen being uniformly brown, and in the femora being wholly light yellow. Length 3–4 mm. Williston, loc. cit. Fore metatarsus about 1¼ times as long as its tibia. St Vincent Island, West Indies.

35. Chironomus fumidus n. sp.

(Pl.28, fig.18)

Male. Fuscous; length 2.5 to 3 mm. Head with palpi, proboscis, and antennae pale fuscous; the basal joint of the last, brown, the second joint yellowish, the hairs pale fuscous. Dorsum

of thorax pale yellowish, pruinose, or with a greenish tinge, with three brown stripes; the scutellum yellow; the metanotum, sternum (and sometimes the pleura also) dark brown. Abdomen dark brown or black, subshining, sometimes the segments with a suggestion of a pruinose margin; hairs pale brown. Legs yellow, the knees and the tarsi somewhat infuscated; tips of the tibiae blackish. Legs hairy, including the fore tarsi; fore metatarsus nearly twice as long as the tibia, the second and third nearly subequal in length, the fourth but little shorter, the fifth shortest. Wings hyaline, sometimes slightly smoky, anterior veins yellow, the crossvein but little if any darker. Halteres pale yellow.

Female. The head with mouth parts and antennae (except the apical joints) more yellowish, thoracic stripes sometimes more reddish, and the abdomen a blackish green; anterior tarsi bare; in other respects like the male.

This species differs from C. h a l t e r a l i s Coq. in having pale halteres and the female having a blackish green abdomen. From C. l o n g i p e s Staeger, an European species, it differs in having shorter tarsi. Ithaca, N. Y., July and August.

36. Chironomus tendens Fabricius

1794 T i p u l a Fabr. Ent. Syst. 4:243, 47
1805 C h i r o n o m u s Fabr. Syst. Antl. p.39, 7
1818 C h i r o n o m u s Meigen. Syst. Beschr. 1:34, 30
1850 C h i r o n o m u s Zett. Dipt. Scand. 9:3525, 45
1864 C h i r o n o m u s Schiner. Fauna Austr. 2:605
1877 C h i r o n o m u s V. d. Wulp. Dipt. Neerl. p.257, 15
1899 C h i r o n o m u s Johnson, in Smith's Cat'l. of N. J. Ins. p.627

Dorsum of the thorax shining reddish yellow, with three wide ferruginous longitudinal stripes, which occupy nearly the whole of the dorsum; the median one abbreviated posteriorly, and only continued in an embossed yellow line to the scutellum; pectus, metanotum and scutellum ferruginous. Abdomen yellow or yellowish green; white-haired; the anterior ends of the segments and on the dorsum of the posterior segments somewhat darker; the forceps slender and strongly upcurved. Head yellow; antennae with the shaft brown, the basal joint and the hairs ferruginous; palpi brownish. Legs pale yellow, sometimes the tip of the tibiae and of the tarsal joints slightly darkened; fore tarsi of the male more or less thickly haired; metatarsus one fourth longer than the tibia. Wings whitish yellow; halteres yellow. The female is wholly shining ferruginous, with rather deeply yellow tinged wings. Length 6.5 to 7.5 mm. Schiner, loc. cit. New Jersey (Johnson).

37. Chironomus lineatus Say

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:14, 5
1859 Chironomus Say. Compl. Wr. 2:42, 5
1828 Chironomus lineola Wiedemann. Aussereurop. zweifl. Ins. 1:17, 6
1878 Chironomus Osten Sacken. Cat'l. Dipt. N. A. p.21
1899 Chironomus lineola Wied. Johnson in Smith's Cat'l. of Ins. N. J. p.626

Wings white; stethidium yellowish testaceous, a fuscous longitudinal line on the anterior dilated line.

Thorax pale greenish, the dilated lines yellowish testaceous, a longitudinal narrow line very distinct and fuscous on the anterior dilated line, and green rather obsolete behind; scutel pale; wings immaculate; feet whitish, incisures of the knees of the intermediate and posterior feet brown; tergum greenish, posterior margins of the incisures dusky. Length of the female nearly three tenths of an inch (7.5 mm.). Pennsylvania. Say, loc. cit. New Jersey (Johnson).

38. Chironomus albipennis Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:248, 87
1850 Chironomus Zett. Dipt. Scand. 9:3526, 46
1864 Chironomus Schiner. Fauna Austr. 2:608
1877 Chironomus V. d. Wulp. Dipt. Neerl. 257, 14
1899 Chironomus Johnson, in Smith's Catalogue of Ins. of N. J. p.627

Shining ferruginous; thorax with three chestnut longitudinal stripes; a spot on each pleuron and the metanotum more or less brown; the scutellum yellow. The abdomen green, in dried specimens brownish above, the anal segments flattened, the forceps short and sublanceolate, the arms incurved, and hairy. Palpi and antennae brown, the hairs of the latter lighter at the tip. Legs pale yellow, the tarsal joints usually darkened; sometimes the extreme tips of the tibiae are also darkened; fore tarsus of the male delicately but distinctly haired, its metatarsus an eighth longer or at least as long as its tibia. Wings white, the costal veins of the female ferruginous, the crossvein not darkened. Halteres pale. Length 5 to 6 mm. A specimen from New Jersey is doubtfully identified as this species by Johnson (1899).

I have a purchased specimen, collector unknown, bearing the label C. albipennis, Riverton, N. J., but which in reality is not albipennis, but is C. nigricans n. sp.

39. Chironomus taenionotus Say

1829 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 6:149
1859 Chironomus Say. Compl. Wr. 2:349
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Female. Stethidium green trilineate; a black line on the middle of the anterior line. Body bright pea-green; head yellowish, terminal joint of the antennae blackish; thorax with three dilated, pale honey yellow vittae; a black line along the middle of the anterior one; wings white; metathorax pale honey yellow; with a blackish spot in the middle, divided by a green line; tergum immaculate; pectus pale honey yellow; feet pale greenish, anterior tibiae and tarsal incisures dusky. Length more than one fifth inch (=5mm.). Indiana. Say, loc. cit.

40. Chironomus fulvus n. sp.

Larvae collected in Beebe lake near the shore in August; reddish yellow in color. Length about 5 mm. The empty larval skin was subsequently lost, hence no further description can be given.

Pupa. A single pupa from which emerged a specimen so greatly resembling the species described below that I believe them to be identical. This pupa had very much elongated respiratory organs; nearly as long as the body, the main trunk flattened, slender, diminishing in diameter toward the end, the apical end subdividing into three or four branches. Each abdominal segment with a transverse row of rather conspicuous spines near the posterior margin, and a number of long setae, three or four pairs of which are laterals, one or two pairs discal, and a marginal pair, all as shown on pl.22, fig.20. The lateral fin of the eighth segment is provided with a somewhat sinuous yellow spur a little caudad of the middle. The caudal fin is fringed with the usual flattened matted filaments, those more caudad being longer and broader than the others (pl.22, fig.23).

Imago. (Pl.28, fig.19). Deep yellow; wings hyaline, yellow tinted. Length 3 to 4 mm.

Female. Head yellowish, occiput dusky, palpi, antennae and proboscis subfuscous; the base of the second joint and sometimes the basal joint and some of the intermediate joints of the antenna yellowish. Dorsum of the thorax pale yellow, with a whitish sheen, with three testaceous stripes, the middle one divided by a fine line. Humeri whitish, scutellum and part of the pleura yellow, the remaining parts of the thorax reddish yellow. Abdomen reddish yellow, the more posterior segments brownish, the posterior margins of the segments a very little, if any, paler; hairs yellow. Coxae and legs yellow, the fore legs excepting the middle section of the femora, and the whole of the middle and hind tarsi excepting the basal half of the metatarsi, fuscous. Tips of middle and hind tibiae with minute black comb. Wings hyaline, with a slight yellow or dusky tint; anterior veins including the crossvein yellow; venation as figured. Halteres pale yel-

lowish, sometimes with a slight greenish tint. In immature specimens the parts described above as dusky are more yellowish. The fore metatarsus is about three fourths longer than the tibia. Numerous female specimens. One bred specimen believed to be the same, the pupa of which is described above. Ithaca, N. Y.

41. Chironomus flavus n. sp.

(Pl.22, figs. 1 to 4; pl.28, fig.20; pl.32, fig.12)

Larva. No eggs were found. The larvae were taken in company with Thalassomyia fusca from the surface of the rocks washed by swift flowing water. Some specimens of the larvae found in August were placed in still water, and in due time transformed and emerged, so that it appears that this species will live in still water also. The full grown larva is pale yellowish green, with pale brown head. Length 6 to 7 mm. and quite slender. The head is rather short, pale brown, the eye spots each consist of a pair of contiguous spots, conspicuously black, and the black ends of the mandibles show prominently. There are several setae upon the head, one in front, one close to but mesad of the eye and a pair on top of the head between the eyes; besides these there is a transverse row of about 6 setae a little distance back of the eyes. The antennae (pl.22, fig.1a) are slender, about the length of the mandibles; the first joint is about three fifths of the whole length, the white apical process of the first joint is nearly as long as the four apical joints taken together. The two apical processes of the second joint are about as long as the third joint. The labrum has about six pairs of rather prominent pale setae, some of them pectinate, and a pair of short pale fan-like processes at the apex. The mandibles (fig.1 md) are stout and have a densely black tip; the maxilla (fig.1 mx) has a prominent palpus, a pair of exceedingly delicate slender mesad projecting processes with several setae. The epipharynx has the usual pair of lateral arms, a transverse comb composed of three hand-like processes, and the curved pectinate hairs. The hypopharynx (fig.1 hy) has the usual papillae. The labium has a conspicuous black margin with the two middle teeth longest, the first laterals much smaller, the second laterals larger than the first, those laterad gradually decreasing in size outwards. The anterior prolegs have numerous curved hairs, the posterior pair (fig.2) with numerous prominent bilobed hooks. The ninth abdominal segment (fig.2) has the normal dorsal tufts of setae, four pale blood gills, of which the apical two thirds of each is considerably smaller in diameter and pointed at the apex. Dorsad of the upper pair is a pair of rather prominent setae.

Pupa. Pale yellow, with yellowish brown thorax; length 3.5 to 4 mm. Thoracic respiratory tracheae are delicate, much branched, and white in color. The second and third abdominal segments (fig.3) each are marked with an anterior transverse row of caudad projecting short setae, the disk more or less covered with smaller and more delicate ones, leaving a number of round clear spaces. The fourth and fifth are like the third, the following ones with fewer setae. The first is bare, the second has besides those mentioned the usual transverse row of black, longitudinal ridges. The anterior lateral margin of the anterior segments is marked with a pale brown cloud, most easily seen in the empty pupal skin. The lateral fin of the eighth abdominal segment has the usual filaments, each fin terminating in a toothed process, deep brown in color (fig.4). The caudal fin has the usual fringe of matted hairs.

Imago, male. Yellow; length 2 to 2½ mm. Head with proboscis, palpi, and basal joint of antenna yellow; antennal flagella and sometimes tip of proboscis pale fuscous. Thorax with all its parts pale yellow, the dorsum with three deeper yellow stripes. In some specimens the metanotum, parts of the pleura and the pectus somewhat deeper yellow. Abdomen wholly pale yellow, with whitish hairs; in living specimens the abdomen is sometimes pale yellowish green; genitalia (pl.32, fig.12) long and slender and yellow in color; the claspers long, the superior lobes blunt with curved spines, the inferior lobes very slender and with an elongate apical seta each. Legs wholly pale yellow, and excepting the first pair rather hairy. Tips of the tibiae with the usual minute black combs. The fore femur is about one third longer than its tibia, and the fore metatarsus is about 1¾ as long. Wings hyaline, with a slight milky tinge, veins colorless; venation as shown on pl.28, fig.20. Halteres white.

Female. Like the male, but the antennae are yellow, apical joints are fuscous. The abdomen has a faint suggestion of white margins on the segments. In some specimens the dorsal stripes are quite indistinct; in living specimens the thorax is sometimes a greenish yellow and the abdomen bright green. This species must not be confused with Tanytarsus exiguus which it closely resembles, but from which it may be distinguished by its distinct radial veins and hairless wings. Ithaca, N. Y.

42. Chironomus brevitibialis Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3537, 59
1864 Chironomus Schiner. Fauna Austr. 2:606
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.261, 22
1898 Chironomus Lundb. Videnskab, Meddel. p.273, 51

This pale green species resembles C. viridis, but is smaller; the thoracic stripes, the sternum and the metanotum pale ferruginous, sometimes subobsolete; the claspers of the male quite long and slender; the legs pale yellow or white; the femora sometimes slightly greenish; the extreme tip of the tibiae and of the metatarsi and the whole of the last tarsal joints brownish. Well-colored specimens, with distinct ferruginous thoracic stripes, have the legs more greenish, and the fore legs brownish. The fore tibia is one third shorter than the femur and the fore metatarsus nearly twice as long as its tibia; the remaining tarsal joints are much shorter; fore tarsi are bare; the hind legs are hairy. Halteres and wings white. Length 3.5 to 4.5 mm. Translation from V. d. Wulp. Greenland (Lundbeck); Washington State; Long Island, N. Y.

43. Chironomus modestus Say

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:13, 3
1828 Chironomus Wied. Aussereurop. zweifl. 1:18, 8
1859 Chironomus Say. Compl. Wr. 2:41, 3
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Larva. (Pl.22, figs.8 to 12). The larva is buff-colored or yellow, with a slight reddish tinge; length 6 to 7 mm. The head is brown with a few dorsal setae; antennae (fig.9) slender, as long as the mandibles, basal joint three fifths of the whole length. The labrum (fig.10 ulr) with a few prominent pale setae, several hairs of which are pectinate. The epipharynx with the usual pectinate setae, lateral arms and transverse comb, the last with but five blunt rounded teeth. Mandibles (fig.11) with blackened teeth. Maxillae (fig.11 mx) with short palpus, several setae and a small group of mesad projecting slender lobes. Labium (fig.11 l) with rounded margin, the teeth with rounded outline, and a pair of ventral setae. Posterior prolegs with bilobed claws, anal blood gills distinct; the posterior dorsal tufts of setae are each placed upon a papilla which is about as broad as long, and which has a very delicate seta on its side.

Pupa. Pale green, length 5 to 5.5 mm. Respiratory organs consist of a pair of tufts of white filaments. Dorsal surface of the fourth abdominal segment (fig.12) marked with two transversely oval patches of microscopic setae near the anterior margin and a large patch with few clear spaces covering the greater portion of the dorsum; this patch is widest at the posterior margin. The third, fifth and sixth segments are similarly marked, but the patches are smaller on the fifth and sixth, and larger on the third; the seventh and eighth are usually bare; the second has the usual transverse row of longitudinal ridges on its posterior margin, and the dorsal surface is marked like that of the

third, though the setae near the posterior margin appear a little more prominent. Near the posterior ventral margin of the first, the anterior and posterior ventral margins of the second, and sometimes on the anterior margin of the third also there is a row of rather long, slender, conspicuous, pale setae. Each lateral fin of the eighth segment has the usual set of four pale filaments and a brownish yellow slightly sinuous tooth (fig.8). The caudal fin has the usual fringe of filaments. The dorsal surface of the first, second and third segments is frequently slightly gray clouded.

The larva and pupa of this species have also been described by Dr Dyar (1902, p.57) from Bellport, N. Y.

Imago, male. Stethidium yellowish, abdomen pea green. Eyes black; antennae, shaft brown, whitish at the base; humerus, scutel and intervals between the dilated lines of the thorax pale; wings immaculate, costal edge near the tip somewhat dusky; feet greenish white, anterior tibia and the tarsi dusky. Length one fifth of an inch (=5 mm.). Pennsylvania (Say); New Jersey (Johnson); Ithaca, N. Y.

To Say's description, given above, may be added the following: The female is like the male, but the antennae are more yellowish and the abdomen more deeply green. The fore tarsi of the male are nearly bare; the fore femur is about one third longer than the tibia, while the metatarsus is about five sixths longer. The male genitalia are figured on pl.32, fig.8, those of the female in fig.11.

There appear to be several varieties of this species, differing slightly in the adult state, and more distinctly in larval and pupal stage. It is possible that when these and closely allied species are better known, my varieties will be considered distinct species.

Var. a. Larva reddish. The fourth abdominal segment of the pupa as shown on pl.22, fig.15; the lateral fin of the eighth segment with comb of several teeth (pl.22, fig.16). The imago differs principally in being smaller, in length not exceeding 3 mm., while the smallest specimens of the typical variety are over 3.5 mm. in length. In color, too, they are more deeply green, including the thorax and legs. The wing venation is as shown on pl.29, figs.1 and 2.

Var. b. The pupa differs from those of the preceding varieties principally in being devoid of spurs at the end of the lateral fin of the eighth segment. The dorsal surface of segments 5 to 9 is marked as shown on pl.22, fig.14. The imago is about 3 mm. in

length; the longitudinal stripes of the thorax rather faint; the male genitalia as shown on pl.32, fig.9; the lateral arms prolonged, curved upwards and enlarged at the ends; the inferior lobes slender, about one half as long as the outer pair, with a slight enlargement at the end; the superior arms are still shorter and curved; the dorsal keel is elongate, curved downwards, and with a slight notch near the tip. Both of these varieties from Ithaca, N. Y.

44. Chironomus fulviventris n. sp.

Larva. Slender, head brown, tip of the mandible and edge of the labium black; each eye consists of two distinct spots. Antennae short, stout, basal joint four sevenths of total length; the appendage at the apex of the first joint longer than the four apical joints. Labrum and epipharynx resembles that of d e c o r u s n. sp., the transverse comb like that shown on pl.22, fig.19; the lateral arms prominent and uniformly brown. Mandibles and maxillae normal; the labium has the middle pair of teeth shorter than the first and second laterals (pl.22, fig.24). The ventral blood gills were not discovered; the four anal gills longer than the anal prolegs; the other appendages normal.

Pupa. The pupa has the dorsal surface of the abdomen marked like that shown on pl.21, fig.11; the terminal spines of the lateral fins of the eighth segment are shown on pl.22, fig.26. The caudal fin has the usual fringe of matted hairs.

Imago. Male, deep yellow; length, 3 to 4 mm. Head yellowish, palpi, proboscis and antennae pale fuscous, the basal joint of the last yellow, its hairs yellowish brown. Dorsum of thorax yellowish with 3 wide testaceous stripes, the middle one divided by a fine line; mesonotum and pectus reddish brown; scutellum and pleura yellowish, the latter with some blotches, reddish brown. Abdomen brownish, the anterior and posterior margins of each segment yellowish. Last 3 segments broadened, all hairs yellowish brown. The genitalia have a pair of elongate lateral arms, a pair of blunt clubbed inferior lobes with curved setae, a pair of hook-like superior lobes and a downward curved keel (one half of these parts are as shown on pl.32, fig.10). The coxae, the femora, particularly the apical half, the basal half of the fore tibiae and the immediate bases of the middle and hind tibiae, the tips of all tibiae, and all tarsal joints yellowish brown; the remaining parts more yellowish or whitish; all hairs pale, fore tarsi bare. The wings hyaline, all the veins pale. Halteres white.

Female. Like the male, but the abdomen is nearly uniformly yellow. In both sexes the fore metatarsus is only about one eighth longer than its tibia. Specimens of larva, pupa and adult, from Saranac Inn, N. Y.; several adults from Ithaca, N. Y.

45. Chironomus pallidus n. sp.

(Pl.29, fig.5)

Male. The thorax yellow; abdomen whitish; length 4 to 4.5 mm. Head yellow, including two basal joints of antennae; proboscis and palpi fuscous or subfuscous; the flagellum of the antenna dusky yellow. Thorax ferruginous, the scutellum, the humeri, space in front of the scutellum and between the ferruginous dorsal stripes is yellowish or whitish; metathorax testaceous, brown or sometimes blackish. Abdomen white; yellowish or pale greenish toward the tip. Genitalia white. Legs white, tip of fore femur, base and tip of fore tibia, blackish; extreme tips of middle and hind tibiae each with a minute black comb; the knees of middle and hind legs sometimes slightly infuscated. Fore metatarsus about one quarter longer than its tibia; fore legs nearly bare, middle and hind ones rather hairy. Wings hyaline, veins nearly colorless. Halteres white.

Female. Antennae yellow with apical joint fuscous. Abdomen pale greenish. Ithaca, N. Y. July and September.

46. Chironomus frequens n. sp.

(Pl.29, fig.7)

Differs from brevitibialis (No. 42) in that the fore metatarsus is only one third longer than its tibia, the tibia more than three quarters as long as its femora. The face and palpi are yellowish in some specimens. The apical one third of the fore tibia and of the metatarsus, the third fore tarsal joint, the whole of the fourth and fifth joints of all the feet, and the tips of all the other tarsal joints, blackish. The tips of the second and third tibiae each with a minute black comb. The paler portion of tibia and metatarsus is white. In other respects the two descriptions correspond. Length 3.5 to 4 mm. Many female specimens. Ithaca, N. Y.

47. Chironomus viridis Macquart.

1834 Chironomus Macq. Suit. à Buffon. 1:52, 21
1838 Chironomus Meig. Syst. Beschr. 7:6, 127
1850 Chironomus Zett. Dipt. Scand. 9:3531, 53
1864 Chironomus Schiner. Fauna Austr. 2:605
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.258, 17
1895 Chironomus Johnson. Proc. Acad. Nat. Sc. Phil. p.320
1767 Tipula? virens Linn. Syst. Nat. ed. XII. 2:975, 34
1838 Chironomus vulneratus Zett. Ins. Lappon. p.814, 28

Male. Dorsum of the thorax greenish yellow, with three ferruginous longitudinal stripes as with C. tendens. The sternum, a spot on the pleura and the metanotum ferruginous. Abdomen a beautiful light green; on the dorsum, particularly

toward the posterior end, somewhat darker; the posterior segments somewhat flattened; the forceps moderately long and strong. Head yellowish, palpi brown, antennae brown, with its hairs lighter, the basal joint yellow. Legs pale yellow; the extreme tip of each tibia brown; the tarsi toward the end somewhat darker; the foremost pair delicately haired, but not bearded; the fore metatarsus one third longer than its tibia; occasionally the fore tibiae and tarsi darkened; the femora, however, are usually somewhat greenish. The fore femora and fore tibiae are of about equal length. Wings whitish, with pale veins.

Female. The antennae are yellow and have brown tips. Length, 5.5 to 6.25 mm. Translation from Schiner loc. cit. Florida (Johnson).

48. Chironomus dux n. sp.

(Pl.29, fig.8)

Larva. The blood-red larva resembles in structural detail that of C. modestus (pl.22, figs. 9 to 11). The labium differs in having the second lateral tooth smaller than the third; somewhat resembling fig.1 on pl.21, but the second lateral is more distinctly separated from the first.

Pupa. The pupa has the dorsal surface of the fourth, fifth and sixth abdominal segments marked somewhat like that shown on pl.22, fig.15. The second and third segments are more widely covered with microscopic setae, leaving here and there small, circular, bare spots. The terminal comb of the lateral fin of the eighth segment resembles that shown on pl.22, fig.16, but the comb stands out more nearly at right angles with the long axis of the body, and the teeth are somewhat curved caudad.

Imago, male. Length 5 to 6 mm. Bright green. Head and proboscis and basal joints of palpi pale green, the apical joints of palpi slightly infuscated. Basal joint of antenna yellow, the flagellum fuscous, the hairs brownish. Dorsum of thorax with its three stripes, the metathorax, the sternum and a few spots on the pleura buff-colored; the humeri, space between the dorsal stripes, space in front of the scutellum, the scutellum and the pleura, green. Abdomen green with pale hairs. Genitalia yellow. Coxae and femora green, middle and hind tibiae greenish or yellowish, fore tibiae yellowish, slightly infuscated. Tarsi fuscous, the metatarsi slightly paler. Middle and hind legs rather hairy; fore legs nearly bare. Fore metatarsus about one third longer than its tibia; wings hyaline, the anterior veins yellow, the crossveins the same color; venation as figured. Halteres green.

Female. Slightly darker than the male. Dorsal stripe of the thorax more brownish, tibiae slightly infuscated, especially the front pair; and the extreme tips of the femora also show a trace of brown. Ithaca, N. Y.

49. Chironomus viridicollis V. d. Wulp

1858 Chironomus V. d. Wulp. Tijds. v. Ent. 2:161, 2
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.254, 9
1898 Chironomus Johnson, in Smith's Cat'l. of Ins. N. J. p.627

Male and female. Thorax green, shining, black, striped; abdomen fuscous; legs yellowish green, the knees and the fore tibiae black; the fore tarsi of the male bare, male anal appendages small and slender. Length 6.75 to 9 mm.

Antennae and palpi dark brown, the antennal hairs of the male yellowish gray. Thorax shining, bright green; the dorsal stripes (of which the middle one is divided by a fine line), two or three spots at the root of the wing, the sternum, and the metanotum, brownish black. Abdomen shining, blackish, with yellow hairs; the posterior margins of the segments appear light gray, and a longitudinal dorsal stripe sometimes becomes visible. The last abdominal segment of the male is not as long as the preceding, its appendages are filiform, pointed, not longer than the eighth segment. Legs greenish yellow; the tip of the fore femur, the entire fore tibia, the knees of the last pair of legs, the tips of the tibiae of the last pair of legs, the tips of the first two joints of all the tarsi, and the whole of the last tarsal joint of all the legs, brownish black. The fore metatarsus is about $1\frac{1}{2}$ times as long as its tibia, the next tarsal joint is one half as long as the metatarsus, the third and fourth are still shorter, and of about equal length, the fifth is the shortest. The fore tarsi of the male are not hairy. The last pair of femora and tibiae are pale haired. Halteres with a pale peduncle and a greenish head. Wings almost hyaline, the costal margin with a brownish tint, the veins brownish, the anterior ones darker; the crossvein somewhat darkened. Translation from V. d. Wulp, loc. cit.

Reported by Johnson from New Jersey. A number of specimens from Ithaca N. Y., cannot be distinguished from the European species. The wing venation is as shown on pl.29, fig.9.

50. Chironomus jucundus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:16
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Male. Wings bare; chest red, with a broad black stripe on each side; scutcheon black; abdomen yellow, hairy; hind borders of the segments and the whole of the latter segments, black; feelers tawny, and adorned with tawny hairs; legs pale yellow, hairy; tips of shanks brown; wings white; veins pale yellow; poisers white. Length of body, $2\frac{1}{2}$ lines (5 mm.); of the wings, 4 lines (8 mm.). Georgia. Walker, loc. cit. New Jersey (Johnson, 1899).

51. Chironomus longimanus Williston

(Pl.29, fig.10)

1896 Chironomus Will. Trans. Ent. Soc. Lond. p.274, 3

Male. Head yellow. Antennae, save the basal joint, black or deep brown, the plumosity grayish black. Thorax light yellow; a blackish brown stripe, running from in front of the root of each wing, and joining in the middle in front, forming a V-shaped figure; below these stripes the sides of the mesonotum are of a purer yellow; the metanotum and a spot below the halteres blackish. Abdomen yellow; a black band on the posterior margin of the first and second segments; the fourth segment, the posterior, or greater part of the fifth segment, and the hypopygium, black or dark brown. Legs yellow; the base and tip of the four posterior femora, and the proximal end of their tibiae brown; front legs much elongate, the metatarsi about one fourth longer than their tibiae. Wings nearly hyaline. Legs, 3 to 4 mm. Williston, loc. cit. St. Vincent Island, West Indies.

52. Chironomus lobiferus Say

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:12, 1
1859 Chironomus Say. Compl. Wr. 2:41, 1
1828 Chironomus lobifer Wied. Aussereurop. zweifl. 1:16, 4
1878 Chironomus Ost. Sacken. Cat'l. Dipt. N. A. p.21

Larva. Blood red; length 14 to 15 mm. Head dark brown, each eye consists of two distinctly separated spots; the antennae are about three fifths as long as the mandibles, brownish in color, the basal joint about five ninths of the whole length, the remaining joints slender (pl.23, fig.2). The mandibles, labrum, and epipharynx resembling those of C. decorus. The setae of the epipharynx pectinate. The teeth of the transverse comb as large as in C. decorus but not all are of the same length. The maxilla and the labium are as shown on pl.23, fig.3; the toothed margin of the latter being deep black. The setae of the anterior pair of legs are curved and hair-like. The anal prolegs have the usual bilobed claws; the four anal blood gills are short, about three times as long as wide; the caudal setae are as usual.

Pupa. The pupa has plumose respiratory filaments; the markings of the dorsum of the abdominal segments consists of a uniformly distributed area of miscroscopic spines. The lateral fins of the eighth segment (pl.23, fig.5) has the usual lateral filaments, and each terminates in a very small comb of about seven teeth. The caudal fin bears the usual fringe of matted filaments.

Imago. Antennae yellowish brown; thorax pale cinereous, the three lines testaceous; scutel and metathorax testaceous; wings white, with a brownish obsolete point near the middle; pectus testaceous; feet pale yellowish, tergum somewhat glaucous, the

segments with their bases and an obsolete longitudinal line black; on the middle of the base of the second, third, fourth and fifth segments is a small, longitudinally oval, slightly elevated lobe, extending nearly one-third the length of the segment. Length three tenths (=7.5 mm.). Inhabits the United States. Say, loc. cit.

The larvae and pupae were collected by Mr C. S. Banks at Albany N. Y. The imago was not bred, but from nearly mature pupae it was determined that on the dorsal surface of the posterior margin of each abdominal segment excepting the last is attached a spiked mace-like appendage (pl.23, fig.4) which extends one third the length of the segment following. On the anterior segments this lobe is somewhat smaller and shorter. As it lies closely applied to the dorsal surface of the segment it appears as if it were a nodule of that segment rather than a process from the segment preceding. The imaginal colors could be distinctly seen through the pupal skin, agreeing with the description given above.

53. Chironomus festivus Say

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:13, 2
1828 Chironomus Wied. Aussereurop. Zweifl. Ins. 1:16, 5
1859 Chironomus Say. Compl. Wr. 2, 41
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Body pale, when recent, light green; pectus, three thoracic lines and scutel testaceous; wings white. Body pale yellowish brown, when recent, pale green; head at base of the antennae testaceous; antennae light brown; eyes deep black; thorax trilineate with testaceous, scutel testaceous; wings white, immaculate; pectus testaceous between the two anterior pairs of feet; feet pale, hairy; thighs green; tarsi dusky at the incisures; anteriors nearly naked, with hairy tarsi; abdomen, second, third, fourth and fifth segments tipped with blackish above. Length of female 7/20 of an inch (9 mm.). Observed particularly in Illinois. Say, loc. cit.

Wiedemann describes both male and female, but gives the length as 6.5 mm. A male specimen bearing the label C. lineola Wied., Westville, N. J., agrees with the above description of festivus, and I believe it to be the latter. In this specimen the fore metatarsus is about 1.4 times as long as its tibia, and the fore tarsi are provided with long hairs. This species seems to be closely related to C. tendens

54. Chironomus willistoni nom. nov.

1896 Chironomus sp. Will. Trans. Ent. Soc. Lond. p.275, 6

Male. Light yellow, the antennae brownish, and, rarely, the posterior part of the abdomen also brownish. Extreme tip of the four posterior tibiae black; front metatarsi about one fourth longer than their tibiae. Wings hyaline; anal angle only feebly indicated. Length 2 to 2.5 mm. Williston, loc. cit. St Vincent Island, West Indies.

55. Chironomus anonymus Williston

1896 Chironomus Will. Trans. Ent. Soc. Lond. p.274, 2

The larvae are described by Dr H. G. Dyar (1902). They are bright red in color, and possess the four ventral blood gills of the eighth segment. The mouth parts are not described. The pupa is of the usual type. Both larvae and pupae were found in a rain-water barrel at Bellport, N. Y.

Imago, male. Head red, or reddish yellow, the front more yellow. Antennae brown, first joint red; plumosity at the tip blackish. Mesonotum light brownish red; two stripes and the humeri yellow; scutellum light yellow. Pleura light brownish or reddish yellow. Metanotum brown. Abdomen blackish, the first segment and the distal part of the next two or three segments yellow or yellowish. Legs yellow; the immediate tip of the tibiae and the tip of all the tarsal joints dark brown; proximal end of the front tibiae also brown; front tibiae about one half the length of their metatarsi, and not longer than the second joint. Wings nearly hyaline. Length 4 to 5 mm. Williston, loc. cit. St Vincent Island, West Indies.

A male specimen from Illinois differs from a St Vincent co-type specimen in being paler, in having the thoracic stripes, pleura, metanotum and sternum pale reddish yellow or buff colored, the remaining parts greenish yellow, the abdomen as described, the paler parts with a greenish tinge.

56. Chironomus innocuus Williston

1896 Chironomus Will. Trans. Ent. Soc. Lond. p.274, 5

Male. Head and basal joints of the antennae light yellowish; palpi brown; antennae brown. Thorax light yellow; mesonotum with a brown stripe in the middle in front, and, on either side, an oval brown spot, the three separated, and the middle stripe bisected by a slender yellow line. Scutellum light yellow. Metanotum brown; halteres brown. Abdomen black, with black hair;

the seventh and eighth segments light yellow, with yellow hair. Legs light yellow; the extreme tips of the four posterior tibiae black; distal joints of the front tarsi infuscated, as also the front tibiae; front metatarsi about one third longer than their tibiae. Wings hyaline. Length 3 to 4 mm. Williston, loc. cit. St Vincent Island.

57. Chironomus similis n. sp.

(Pl.29, fig.13)

Resembles C. cristatus Wied.; differs in being smaller and in having proportionately longer fore metatarsi. Length 3 to 4 mm.

Male and female. Head brownish, palpi and antennae including basal joint dark brown, antennal hairs of the male yellowish brown. Thorax dusky yellow, the three dorsal stripes and sternum brown, scutellum yellow, metanotum blackish. Abdomen brown, posterior margins of the anterior segments widely yellowish, with cinereous bloom; anterior margins narrowly yellowish, the brown marking prolonged caudad along the middle line; posterior segments almost wholly brown with cinereous bloom. Legs yellow or yellowish brown, knees and tarsi sometimes a little darker. Fore metatarsus three fourths longer than the tibia; fore tarsi nearly bare; middle and hind legs hairy. Wings hyaline, veins yellow, crossvein brown though not very prominent. Halteres yellow. Chicago, Ill., Brookings, S. D., and Ithaca, N. Y.

58. Chironomus redeuns Walker

1856 Chironomus Walker. Ins. Saunders, I. Dipt. p.422
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21
1900 Chironomus Coq. Proc. U. S. Nat. Mus. 22:250

Female. Wings bare. Tawny. Antennae brown, tawny at the base. Thorax with four brown stripes, the outer pair paler, broader and shorter than the inner pair. Abdomen brown, with a hoary band on the hind border of each segment; under side tawny. Legs testaceous; tips of the femora, of the tibiae and of the joints of the tarsi brown. Wings limpid; veins brown, strongly defined; discal mark distinct. Halteres testaceous. Length of the body 3 lines (=6 mm.); of the wings 5 lines (=10 mm.). United States. Walker, loc. cit. Puerto Rico and Mississippi (Coquillett, loc. cit.).

59. Chironomus plumosus Linne

1758 Tipula. Syst. Nat. ed. X. p.587, 19
1761 Tipula. Fauna Suec. ed. II. p.434, 1758
1767 Tipula. Syst. Nat. ed. XII. 2:974, 26

1804 Chironomus Meigen. Klass. 1:11, 1
1818 Chironomus Meigen. Syst. Beschr. 1:20, 1
1850 Chironomus Zett. Dipt. Scand. 9:3481, 1
1864 Chironomus Schiner. Fauna Austr. 2:601
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.249, 1
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21
1805 Chironomus annularis Latr. Hist. Nat. d. Crust. et d. Ins. 14:289, 1
1818 Chironomus grandis Meigen. Syst. Beschr. 1:21, 2 (Pl.29, fig.11)

The larva and pupa were obtained from the swamps in the vicinity of Cayuga lake, Ithaca, N. Y. No adults were reared, although several were captured in the neighborhood. The extremely large size of the larva and pupa, together with the coloring of the latter, lead me to believe that my specimens are the early stages of C. plumosus. In fact the only species which has been taken here in a number of seasons collecting which is large enough to have larva and pupa of this size is plumosus, and I therefore shall tentatively so consider it.

Larva. Blood red, length of body about 22 mm. Head brown, antenna short and stout, basal joint about half as long as the mandible; the latter with blackened teeth and with the usual mesad projecting setae. Labrum, epipharynx and hypopharynx were destroyed. Maxilla with short palpus and a mesad projecting lobe with setae and papillae as shown in fig.16 of pl.23. Labium (pl.23, fig.15) broad with short blunt teeth; the middle tooth broad with a nearly straight apical margin, the first lateral small and more or less rounded, the second lateral broad and a little longer than the middle one; the third pair smaller and closely united with the second; fourth, sixth and seventh laterals about of equal size with rounded margins, the fifth slightly smaller. Anterior prolegs with very numerous fine hair-like setae. Ventral and anal blood gills present. The larva (4) mentioned by Garman (1888) is probably this species.

Pupa. Grayish brown in color; the markings of the enclosed imago visible; length about 16 mm. Respiratory filaments much branched and whitish in color. The dorsum of the abdominal segments uniformly covered with microscopic spines, those nearest to the posterior margins of the segments a little stouter than the others. The lateral fin of the eighth segment terminates in a chitinous process or spur, the extremity of which is divided into 7 or 8 spines in close contact (pl.23, fig.14). Caudal fin with the usual fringe of matted filaments. The mutilated condition of the larva and pupa renders further description impossible.

Imago, male and female. Dorsum of the thorax dull pale yellow, with three blackish gray, wide, longitudinal stripes, middle one posteriorly, the lateral ones anteriorly abbreviated; in front of the scutellum with a shining whitish gray spot; pleura near the coxae darkened, with grayish sheen; metanotum gray. Abdomen pale yellowish, each segment with a broad brown spot, which often widens into cross bands, the last few segments and the sides of the others in certain lights with whitish gray sheen, the hairs pale yellow; the last few segments flattened, the anal one with its incisure deep, the forceps brownish yellow, slender. Head yellowish; antennae brown, the hair is light brown; palpi ferruginous, often quite dark. Legs yellow, the knees darkened, the other articulations, narrow blackish brown; fore tarsi of the male with long hairs; metatarsus one fourth longer than the tibia; middle and hind legs delicately but long and thickly haired. Wings whitish with a black spot. The female quite robust, colors darker, abdomen brown, with gray reflections, the incisures appearing at most slightly whitish, the antennae yellow, at the end brownish. The coloring of this species is variable, sometimes lighter, sometimes darker, occasionally it has a touch of ferruginous, which is then particularly noticeable on the antennal hairs; on the whitish-gray posterior segments of the abdomen often appear regularly arranged brown markings. The metamorphosis of this species was first described by Reaumur. Length, 11 to 12 mm. Schiner, loc. cit.

Brought from Mackenzie river by R. Kennicott (Ost.-Sack., loc. cit.). Reported from Chautauqua lake N. Y., by C. V. Riley (1886). Some male and female specimens from Ithaca N. Y., and Washington State, agree with the description and with specimens from Europe in all particulars.

59a. Chironomus ferrugineovittatus Zetterstedt.

1850 Chironomus Zett. Dipt. Scand. 9:3492
1864 Chironomus Schiner. Fauna Austr. 2:602
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.251

Male and female. Head yellow, the antennae and palpi brown, antennal hairs of the male dusky yellow, antenna of the female yellow with a brown apical joint. Thorax pale yellow, with three broad ferruginous longitudinal stripes, pleura with ferruginous spots; pectus and metanotum gray; the flattened area in front of the scutellum with a whitish sheen. Scutellum as also the abdomen of the male for the most part yellowish, both with a suggestion of green; upon some of the abdominal segments a brown dorsal mark; the posterior segments with a whitish sheen;

the anal segment cordate, a third shorter than the one immediately preceding; forceps brownish yellow, slender and pointed; the hairs on the sides yellowish; abdomen of the female dark gray, with whitish incisures. Legs yellow with brownish articulations; the last two tarsal joints darkened; tarsal proportions as in plumosus; male fore tarsi hairy. Halteres yellow. Wings with a slightly yellow tinge, whitish in reflected light; the cross vein dark brown. Length 9 to 12 mm. Washington State.

60. Chironomus decorus n. sp.

(Pl.23, figs. 7 to 13; pl.29, fig.12)

Larva. The larvae were found everywhere in the ponds and ditches around Ithaca N. Y. They are blood red, and about 12 mm. long. The head is dark blackish brown; the antennae are short, normal. The dorsal sclerite is narrow ovate, posterior end pointed, truncate anteriorly, with three setae along each lateral margin, the first at the extreme anterior end, the last one half way between the anterior and the posterior end, the second midway between these. Articulated to the cephalic margin, and overhanging the mouth opening is the labrum. There are two pairs of prominent setae upon its dorsal surface; numerous papillae, two or which are quite prominent on the anterior margin and upon the anterior ventral surface. The arrangement of the setae and the armature of the epipharynx shown in fig.10. The epipharyngeal comb (c) has relatively long and uniform teeth; the lateral arms are dark brown in color. Each eye consists of two distinctly separated pigment spots. The mandibles (fig.7) are black-tipped, with a fringe of apical setae, a prominent lateral spine, and a group of mesad projecting branched setae; the hypopharynx has its usual papillae upon the fore margin; the maxillae are prominent, each with two lateral setae, the palpus is short and thick. The labium has a black margin with an outline as shown in fig.8. In many specimens the teeth appear to be slightly longer in proportion than shown in this figure. The anterior prolegs have very numerous curved setae. The body is nearly devoid of even minute setae. The anal prolegs are normal, claws dark, bilobed. Anal setae as usual. The eleventh body segment has four long white blood gills on the ventral surface, and caudad of the dorsal setae of the twelfth segment are four short ones.

The larva (1) mentioned by Garman (1888) is probably this species.

Pupa. Dusky greenish brown, the colors of the imago showing through the integument. Length 7 to 8 mm. Tracheal filaments prominent, white and much branched. Thorax with a few scat-

tered setae. Segments of the abdomen with a seta-pattern as shown in fig. 11 and 12; the pattern more indistinct on the last two segments. On each lateral margin of the fifth to the eighth segment there is a brown longitudinal dash, most conspicuous and half the length of the segment on the fifth. The black chitinized lateral spur of the eighth segment is prominent and without teeth (fig.12). The anal appendage has the usual fringe of matted hairs.

Imago, male. Length 6 to 7 mm. Head yellow, antennae and proboscis more or less brownish, large basal joint of the antennae and the palpi reddish brown, the latter sometimes fuscous. Thorax greenish yellow with a whitish sheen, the pleura and the scutellum the same color; the three thoracic stripes, some pleural spots, the metathorax and the pectus dull testaceous or reddish, sometimes even brownish; the middle dorsal line divided by a fine line. Abdomen hairy, pale yellow or greenish yellow, in life more distinctly green, infuscated toward the tip; each segment with a brownish transverse fascia slightly in front of the middle. These fasciae are widest on the dorsal line, and are obsolete on the last few segments. Genitalia brownish yellow, hairy, moderately elongated (pl.32, fig.13). Legs including the coxae pale greenish yellow, short haired; tarsi, particularly towards the tip, infuscated; tips of tibiae and of all tarsal joints fuscous, fifth joint wholly fuscous. Tarsal claws simple, pulvilli small, empodium stout, curved, blunt, and pectinate on the convex side. The fore metatarsus about 0.6 longer than its tibia. Wings hyaline, crossvein conspicuously clouded with dark brown, anterior veins yellow, posterior ones hyaline, the two branches of the cubitus and the anal vein accompanied by a faint brown streak. Venation as shown on pl.29, fig.12.

Female. Differs from the male as follows: Slightly shorter, antennae yellow, last joint fuscous; thorax more greenish than yellow, abdomen greenish with dark bands as in the male, but the bands are always wider and usually cover the whole surface of the segment excepting the apical third or fourth. In other respects like the male. This species seems to be very common in many parts of the country. New York, Ohio, Illinois, Iowa, Kansas, Washington State, and Nebraska.

60a. Chironomus dorsalis Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:25, 10
1850 Chironomus Zett. Dipt. Scand. 9:3529
1864 Chironomus Schiner. Fauna Austr. 2:605
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.255
1830 Chironomus cingulatus Meig. Syst. Beschr. 6:245

1850 Chironomus Zett. Dipt. Scand. 9:3498
1834 Chironomus nigroviridis Macq. Suit. Buffon. 1:51
1850 Chironomus Zett. Dipt. Scand. 9:3529
1839 Chironomus venustus Staeger. Kröj. Nat. Tidsskr. 2:562
1850 Chironomus Zett. Dipt. Scand. 9:3496
1864 Chironomus Schiner. Fauna Austr. 2:603
1847 Chironomus waldheimii Gimmerth. Bul. Soc. Imp. Nat. Moscou. 20. 2:142, 69

Larva and pupa. Miall and Hammond (1900) state that the larva is blood red, and possesses both the ventral blood gills of the eleventh segment and the anal blood gills of the twelfth. The labium is as shown on pl.23, fig.1. The pupa is of the usual type, resembling the one shown on pl.16, fig.2. The abdominal markings and the spurs of the lateral fin of the eighth segment are not described.

Imago, male and female. Head yellowish; palpi and antennae dark brown, the last usually yellowish or reddish yellow at the base, the antennal hairs of the male pale brown with reddish yellow sheen; very dark varieties (var. nigroviridis) dark brown with pale brownish sheen. Thorax yellow, yellowish green, sometimes very pale green; the thoracic stripes, the pleura and the sternum chestnut, sometimes ferruginous, sometimes blackish; the metathorax always blackish brown; the middle thoracic stripe of the male divided by a fine depressed line, in the female more distinctly separated. Abdomen of the male a translucent green or yellowish green; the second and the following segments each with a large blackish brown dorsal mark which frequently is in the form of a cross band; the last segments are wholly blackish brown, with a whitish shimmer; abdomen of the female blackish brown with pale green pruinose margins to the segments. Legs pale green or yellowish; tips of the tibiae and of the tarsal joints brown; the fore metatarsus 1.5 times as long as the tibia, and nearly twice as long as the second joint; the following joints gradually diminishing in length; the fore tarsi bare. Halteres yellowish. Wings hyaline, the veins pale brown, the crossvein usually slightly clouded. Length 5.75 to 7.5 mm. Connecticut, Pennsylvania, South Dakota, Kansas.

61. Chironomus stigmaterus Say.

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:15, 6
1859 Chironomus Say. Compl. Wr. 2:42, 6
1828 Chironomus glaucurus Wied. Aussereurop. zweifl. 1:15, 3
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Tergum pale, toward the tip glaucous.

Male. Antennae pale yellowish brown; thorax pale cinereous, lines very pale testaceous, sometimes tinged with dusky; scutel

yellowish; metathorax reddish brown; wings white with a fuscous subcentral stigma; pectus testaceous; feet pale yellowish; tergum, basal segments pale reddish brown with whitish tips, terminal segments somewhat glaucous. Length 0.3 inch (=7.5 mm.). Habitat United States.

I have seen specimens, which I identify as this species and agreeing perfectly with the above description, from Kansas, Washington State, California, Wisconsin, Idaho, New Jersey and South Dakota. The male has hairy fore tarsi; the fore metatarsus in both sexes is about one-fifth longer than the tibia. The species resembles c r i s t a t u s but differs in having paler thoracic stripes, in being generally paler, and in its metatarsal proportions. From f e s t i v u s and t e n d e n s it differs in having a darkened crossvein.

62. Chironomus cristatus Fabr.

1805 C h i r o n o m u s Fabr. Syst. Antl. 39, 4
1821 C h i r o n o m u s Wied. Dipt. exot. 1:11, 1
1828 C h i r o n o m u s Wied. Aussereurop. Zweifl. Ins. 1:14, 1
1878 C h i r o n o m u s Ost. Sack. Cat'l. Dipt. N. A. p.20

(Pl.29, fig.14)

Male. Dorsum of the thorax yellowish, with grayish-brown stripes; abdomen yellowish, brown banded. Length 8 mm.

Antennae brownish. The dorsum of the thorax with the usual three stripes, which, however, are not lead-colored, since they lack the metallic lustre, but are brown, and appear in different lights to be covered with a grayish bloom; the pleura have grayish spots, the sternum and the metathorax ash-gray. The brown cross band of each segment of the abdomen lies at the base of the segment; each band is somewhat wider at the middle, where it is somewhat prolonged into a fine line, sometimes reaching the posterior margin of the segment. Legs yellowish. North America. Wiedemann, loc. cit.

According to Fabricius (1805) the head is blackish and the legs pale with blackish articulations. Some male and female specimens from Chicago, Ill., and Ithaca, N. Y., agreeing with Wiedemann's description may be further characterized thus: Face and palpi brown; large basal joint of the antenna brown in the male; in the female the antenna is yellow except the apical joint; scutellum yellowish; the last two or three abdominal segments nearly wholly dark brown with cinereous bloom; male genitalia

dark brown. Legs yellow, knees of the fore legs and the fifth tarsal joint of all the legs pale brown; extreme tips of all the tibiae and of all the tarsal joints dusky; fore metatarsus about 1.5 times as long as its tibia; fore tarsi of male bare. Wings hyaline, veins yellow, the crossvein brown. Length 6.5 to 8 mm. New York, Illinois, Washington, Kansas, Idaho, South Dakota, New Jersey (Johnson).

62a. Chironomus tentans Fabricius

1805 Chironomus Fabr. Syst. Antl. p.38, 3
1818 Chironomus Meigen. Syst. Beschr. 1:24
1850 Chironomus Zett. Dipt. Scand. 9:3482
1864 Chironomus Schiner. Fauna Austr. 2:603
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.255
1818 Chironomus abdominalis Meig. Syst. Beschr. 1:32, 25
1804 Chironomus vernalis Meig. Klass. 1:13, 5

Larva. Concerning the larva Weyenbergh (1874) writes:

"The larvae were found among the rotting leaves in the water. They were full grown in March and the beginning of April; blood red in color, long and slender in form, and about 20 mm. in length. . . . The mandible is deep brown, chitinized and sharply toothed, particularly the vertex (pl.37, fig.28) is very sharp. The lower lip (labium) is also sharply toothed, the teeth symmetrically placed as shown on pl.37, fig.27. . . . The anal appendages are large. . . ."

Imago, male and female. Length 7.5 to 9.75 mm. Head grayish yellow; palpi dark brown; antennae of the male dark brown, the hairs paler brown, sometimes verging upon ferruginous; antennae of the female reddish yellow, darkened apically. Thorax pale yellow or light green; the moderately wide thoracic stripes, a line produced posteriorly from the median stripe to the scutellum, a part of the pleura and the metanotum, dark gray; the whole thorax especially when viewed from behind, with a whitish sheen. Abdomen dark gray, the segments with whitish or grayish posterior margins; the anal segment of the male short and broad, the claspers bent, *unusually stout*. Legs yellowish, the knees, the tips of the tibiae, and the whole of the tarsi, blackish; the fore metatarsus nearly one half longer than its tibia, the second tarsal joint about half as long as the first and but little longer than the third; the latter but little longer than the fourth; the fore tarsi not ciliate, even the hairs of the hind legs inconspicuous; these legs in both sexes robust. Halteres yellowish. Wings whitish; the anterior veins pale brown, crossvein slightly darker, the other

veins nearly colorless. The thoracic stripes of some specimens are ferruginous; the ground color of the entire insect in this case verges toward green; the antennal hairs of the male is then also mainly pale yellow. In this species the pale thorax contrasts strongly with the dusky abdomen. Translation; V. d. Wulp. loc. cit.

According to Zetterstedt (1850) the ratio of fore metatarsus to tibia is the same as in plumosus (i. e. one and one fourth to one). This is the case in specimens from Ithaca, N. Y., Idaho, South Dakota, Utah, Iowa.

63. Chironomus prasinus Meigen

1818 Chironomus Meig. Syst. Beschr. 1:22, 4
1877 Chironomus V. d. Wulp. Dipt. Neerl. p.250, 2
1839 Chironomus intermedius Staeg. Kröjer: Naturh. Tids. 2:559, 3
1850 Chironomus Zett. Dipt. Scand. 9:3484, 3
1864 Chironomus Schiner. Fauna Austr. 2:601
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20
1818 Chironomus pilipes Meig. Syst. Beschr. 1:26, 13

Resembles plumosus but is smaller, the abdomen in living specimens is light green (which color in dried specimens becomes yellowish) with blackish dorsal spots which sometimes spread out in the form of a cross band, seldom wanting; posterior margins of the segments with a whitish sheen; abdomen of the female darker; with greenish white pollinose, posterior margins to the segments. The ratio of tibia to metatarsus, the hair of the legs, etc., like plumosus. Length 7.5 to 9 mm. Translation, V. d. Wulp, loc. cit. Northwest of North America. Osten-Sacken (1878). Idaho, Minnesota, New York.

According to Hammond (1885) the larva is blood red, and possesses both anal and ventral blood gills. Judging from a drawing given by him the labium of the larva appears to be like that figured on pl.37, fig.25.

64. Chironomus polaris Kirby.

1824 Chironomus Kirby. Suppl. App. Parry's 1st Voyage. CCXVIII
1831 Chironomus Curtis. Ross' Voyage. LXXVII
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21
1898 Chironomus Lundb. Vidensk. Meddel. p.288

Black, hairy, wings lacteous, iridescent, the costa fuscous with nervures darker, halteres dirty ochre. Length 7.5 mm. Breadth, 12 mm. Curtis, loc. cit.

Lundbeck (1898, 272) says in regard to this species and C. borealis Curtis, that they are probably identical with either C. hyperboreus or C. staegeri. He says further that C. polaris of Holmgren is not identical with either of the above-named species, he having seen the Holmgren specimens. In Holmgren's species the fore metatarsus is shorter than the tibia, while according to the figure given by Curtis in Ross' Voyage LXXVII, it appears that polaris Kirby is a true Chironomus (sens. str.). Arctic regions.

65. Chironomus attenuatus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:20
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Body dark gray, thinly clothed with yellow hairs; abdomen very long, fringed with hairs on each side; feelers brown; legs dull yellow, hairy, especially the four hinder thighs and shanks; fore feet very long, hairy at the base; wings slightly gray, with the usual dark spot on each, and having a fringe of very short hairs; veins brown; poisers dark gray. Length of the body 3 lines (=6 mm.); of the wings 5 lines (=10 mm.). St Martin's falls, Albany river, Hudson's bay.

According to the heading of the group to which this species belongs the author states that the wings are hairy. White mountains, New Hampshire (Slosson).

66. Chironomus crassicollis Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:18
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Body blackish brown, downy; chest thick; abdomen much narrower than the chest; feelers and legs brown; wings white, not hairy, very iridescent; veins pale yellow; poisers brown. Length of the body one line (=2 mm.); of the wings 1.5 line (=3 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

67. Chironomus fimbriatus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:20
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Body brown, hairy, abdomen fringed with hairs; feelers and legs pale brown, the latter hairy; wings colorless, hairy, fringed; poisers pale brown. Length of the body one half line (=1 mm.); of the wings one line (=2 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

68. Chironomus nigritibia Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:16
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Wings bare; chest black; abdomen yellow at the base; palpi brown; legs yellow; tips of thighs and of shanks, and of joints of the feet, black; wings colorless; a broad brown band across each wing, faint toward the hind border; veins brown; yellow towards the base; poisers lemon-color. Length of body 2.25 lines (=4.5 mm.); of wings 4.5 lines (=9 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

This species may be the same as C. brachialis Coq.

69. Chironomus borealis Curtis

1831 Chironomus Curtis. Ross' Voyage. LXXVII
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Black, thorax gray, abdomen with 7 whitish rings; costa fuscous; legs lurid. Length, 6 mm. Breadth, 12 mm.

Black, basal joint of the antennae ochreous; thorax hoary; abdomen clothed with long subdepressed yellowish hairs, the margins of the segments shining whitish or silvery; wings lacteous, opalescent, the costa fuscous, the nervures darker; halteres yellow; legs dull castaneous ochre, tips of the thighs and tarsi fuscous. Arctic regions. Curtis, loc. cit. Greenland.

According to Lundbeck (1898) this species may be the same as either C. hyperboreus, or C. staegeri, though Curtis' description is too brief to admit of a positive statement.

70. Chironomus albistria Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:17
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Body reddish brown; stripes on the chest red or flesh-color; side stripes passing into two broad white stripes; sides of chest hoary; scutcheon pale red; abdomen dark brown, hairy; sutures of the segments paler; feelers pale brown; legs pale tawny, hairy; tips of thighs, of shanks, of feet, darker; wings whitish, not hairy; veins pale yellow; poisers white. Length of the body 3 lines (=6 mm.); of the wings 4.5 lines (=9 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

71. Chironomus brunneus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:21
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Wings hairy. Head and chest brown, the latter with the usual three stripes of a pale gray color; abdomen of a yel-

lowish brown; feelers brown; legs yellowish brown; thighs yellow at the base; wings colorless; veins and poisers yellow. Length of the body 1.75 lines (3½ mm.); of the wings 3.5 lines (=7 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.; New Jersey (Johnson).

72. Chironomus lasiopus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:19
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Female. Wings hairy. Head and chest yellow; the usual three stripes on the latter brown, confluent, and occupying the whole of the back; feelers brown; scutcheon dingy yellow; hind chest black; abdomen brown, with a broad, dingy yellow band on the hind border of each segment; legs clothed with short yellow hairs; thighs yellow; shanks darker; feet brown; wings colorless, with the usual spot on the disk; veins brown, poisers pale yellow. Length of body, 2.5 lines (=5 mm.); of the wings, 4 lines (=8 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

73. Chironomus hilaris Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:17

Male. Wings bare. Body straw-color; head and chest tawny, the latter produced in front, and having its usual three stripes of a yellow color; feelers tawny; eyes black; legs brown; thighs white towards the base; middle shanks pale yellow, excepting the base and the tips; wings white, each having a broad, irregular, brown band across its disk; veins yellow; poisers pale yellow. Length of the body 1.5 lines (=3 mm.); of the wings 3 lines (=6 mm.). Habitat unknown. Walker, loc. cit.

74. Chironomus anticus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:21
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Wings hairy. Chest a little produced in front, silky white, with the usual three stripes of bright tawny color; abdomen pale yellow, hairy; last two segments dull tawny; legs pale yellow, hairy; a tawny band round each hind thigh; tips of the thighs, of the shanks, and of the joints of the feet, tawny; wings whitish from the base to the middle, pale tawny thence to the tips, slightly fringed; poisers pale yellow. Length of body 2.5 lines (=5 mm.); of wings 4 lines (=8 mm.). Georgia. Walker, loc. cit.

75. Chironomus bimacula Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:15
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Female. Wings bare; body citron color; chest produced in front, with the usual three stripes of orange color; a black dot

at the tip of each side stripe; feelers brown; legs dingy yellow; wings pale; veins and poisers pale yellow. Length of body 1.25 lines (=2.5 mm.); of wings 2.5 lines (=5 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

76. Chironomus confinis Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:15
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Pale yellowish green; chest with the usual three lines dull red; the middle stripe divided; hind chest brown; abdomen green, yellowish towards the base, darker at the tip; the sides hairy; feelers brown; legs dull yellow, hairy; wings colorless, hairy; veins pale brown; poisers white.

Female. Chest yellow; middle stripe not divided; abdomen dingy yellow. Length of the body one line (=2 mm.); of the wings two lines (=4 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit. In the heading of the group Walker says that the wings are bare.

77. Chironomus pellucidus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:21
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Male. Body pale yellowish green; feelers pale brown; abdomen and legs very hairy; wings colorless, hairy, deeply fringed; veins dull yellow; poisers pale yellow. Length of the body $\frac{3}{4}$ line (=1.5 mm.); of the wings 1.5 line (=3 mm.). St Martin's falls Albany river, Hudson's bay. Walker, loc cit.

78. Chironomus trichomerus Walker

1848 Chironomus Walker. List Dipt. Brit. Mus. 1:21
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Male. Wings hairy. Pale greenish yellow; sides of abdomen fringed with hairs; eyes black; feelers and legs yellow, the latter thickly clothed with short hairs; wings whitish, deeply fringed; poisers pale yellow. Length of the body one line (=2 mm.); of the wings two lines (=4 mm.). St Martin's falls, Albany river, Hudson's bay. Walker, loc. cit.

79. Chironomus sp.

(Pl.23, fig.13)

In the figure mentioned above is shown the labium of a blood worm found in Fall creek, Ithaca N. Y., in the quiet water. This labium resembles that of Chironomus decorus, but the teeth are considerably longer.

80. Chironomus sp.

1896 Chironomus Osborn. Bul. Iowa Exp. Station. p.405

The larvae were found in the city water at Boone, Iowa. The larva is figured and briefly described by Osborn, loc. cit. It is blood red, possesses the four ventral blood gills of the eleventh segment as well as the anal gills. The figure shows the labium with the middle tooth shorter than the first laterals; the last laterals longer than those immediately preceding (pl.37, fig.26, after Osborn).

81. Chironomus sp?

(Pl. 22, fig.7)

Yellow larvae 6 or 7 mm. long from Saranac Inn N. Y. Head pale yellow, tip of mandible and labium black. The labrum, antennae and epipharynx resemble that of Orthocladius shown on pl.25, fig.3. The lateral surface of the mandible is not wrinkled; the maxillae and the labium are as shown in pl.22, fig.7. The setae of the anterior prolegs are delicate, curved and apparently not pectinate. The posterior appendages resemble those shown on pl.25, fig.6.

82. Chironomus sp.

(Pl.22, fig.22)

Larvae from Saranac Inn and from Ithaca N. Y. Blood red; length 8 to 10 mm.; resembling the larvae of C. flavicingula. Differ in having the middle pair of teeth of the labium paler than the laterals.

83. Chironomus sp.

A blood worm from Beebe lake, Ithaca N. Y.; resembles the larva of C. flavicingula in form, size, color, shape of prolegs, and appendages, etc. but differs in the form of its labium. there being an even number of teeth arranged as shown on pl.23, fig.6.

84. Chironomus sp.

The larvae (collected at Saranac Inn N. Y.) construct loose, black, cylindrical cases composed of sand, decaying leaves, etc. These cases are about four times as long as wide. The length of the larva is about 10 mm.; the maxillae resembles that shown on pl.22, fig.7. The margin of the labium is as shown on pl.22, fig.21. The eyes are each composed of two distinctly separated spots.

85. Chironomus sp.

1900 Chironomus Pettit. Mich. Acad. Sc.

The larvae are pale green in color, and very small and slender. They were found to mine in the water-lily leaves. The insect works by tunneling or plowing a furrow which extends from the

top of the leaf to the lower epidermis. This tunnel is often several inches in length and winds about in all directions in a serpentine manner. . . . From the front end of this tube the insect extends its head and feeds. . . . The pupae are apple-green in color, as are also the adults. Michigan.

Five species of larvae of Chironomus have been described by Garman (1888). Of these No. 1 is probably identical with C. decorus; No. 4 with plumosus; the others are described below.

86. Chironomus sp. Garman

1888 Garman. Illinois State Lab. Nat. Hist. Bul. 3:160

Larva No. 2. Length about 10 mm. Head pale brown, under side black. Two eye specks. Labium with four teeth on each side; median tooth shorter than the two next it. Hairs of anterior pediform appendage rusty. A pair of small club-shaped (respiratory ?) appendages at posterior edge of the penultimate segment. Anal papillae conspicuously enlarged distally. Illinois.

87. Chironomus sp. Garman

1888 Garman. Illinois State Lab. Nat. Hist. Bul. 3:160

Larva No. 3. Length about six mm. A single eye speck. Posterior segments without fleshy respiratory appendages. Anal papillae apparently jointed. Illinois.

88. Chironomus sp. Garman

1888 Garman. Illinois State Lab. Nat. Hist. Bul. 3:160

Larva No. 5. A very small pupa (3 mm.) taken in August still retained its larval skin, the labium of which differs from that of the preceding larvae in lacking the median tooth. Its condition would not permit of more extended comparison with the others, and it may prove the same as (3).

Genus 39. Cricotopus V. d. Wulp

Tijdschr. v. Entom. XVI (LXX) and XVII. 132

Larva. Small, yellowish or green in color, the anterior abdominal segments stouter than the posterior ones. Eleventh segment without ventral blood gills. Antennae, labium, epipharynx and labium essentially like those of Chironomus. Maxilla with a number of mesad and cephalad projecting blades (pl.24, fig.1 *mx*). Mandible frequently transversely corrugated on its convex surface (pl.24, figs. 4 and 6). The anterior feet frequently with coarse pectinate setae.

Pupa. The thoracic respiratory organs are simple, tube-like, sometimes with enlarged extremities. Abdominal segments with minute and short setae. The anal segment with 6 terminal setae, three on each side.

The larvae and pupae of Orthocladius do not seem to differ from Cricotopus.

Imago. This genus resembles Chironomus, from which it is distinguishable in having the fore metatarsus a half or a third shorter than the tibia. The last abdominal segment of the male is much shorter than the preceding and is broader than long; the claspers are short and broad, and usually white in color (pl.33, fig.2). The legs are white and black annulate, the fore tarsi are bare or covered with very short and inconspicuous hair (in an exceptional case the male has bearded tarsi); the hind tarsi are also usually bare. The halteres are always white or pale yellow. Wings bare, the anal angle, particularly in the male, is prominent; R_{4+5} is straight or slightly bent at its extremity, the crossvein is a little beyond the middle of the wing; the cubitus is forked, the base of the fork a little distad of the crossvein; the lower branch is straight or gently arched toward the hind margin; the humeral crossvein is wanting or rudimentary.

The species of this genus are all small (2 to 4 mm.) and with black and yellow coloring, the dorsum of the thorax has 3 shining black stripes, which sometimes are so wide as to entirely obliterate the yellow dividing lines, so that only the humeri remain yellow.

KEY TO SPECIES OF CRICOTOPUS

Larvae

a Sides of each abdominal segment with pencil of long hairs, pl.24, fig.9 ..... 3. trifasciatus

aa Abdomen without such pencils

b Middle tooth of the labium longer than the first laterals, pl.24, figs. 1, 2, 4 ..... 4. exilis n. sp.

bb Middle tooth about as long as the first laterals, pl.25, fig.22 ..... 6. varipes

Pupae

a Pattern upon each abdominal segment in two wide transverse bands, resembling that shown on pl.25, fig.7 ..... 4. exilis n. sp.

aa Not marked in this manner

b Markings as shown on pl.24, fig.7; thoracic respiratory organs as shown on fig.8 ..... 3. trifasciata

bb Dorsum uniformly covered with minute spines ..... 6. varipes

Imagines

a At least the apical half of the middle and hind femora black
b Abdominal segments with narrow white posterior margins; fore metatarsus about one fourth or one third shorter than its tibia
1. tremulus
bb Abdomen with wide white or yellow fasciae
c Abdomen with the first, most of the third, half of the fifth, and posterior margins of the second and the fourth, yellow
2. geminatus
cc Abdomen not marked in this manner
d With the fore metatarsus about one half as long as the tibia
e With yellow bands on the first, fourth and seventh segments
3. trifasciatus (var. tricinctus)
ee With yellow bands on the first, fourth and fifth segments
4. exilis n. sp.
dd With the fore metatarsus about two thirds as long as its tibia
e With yellow bands on the first and fourth segments
5. bicinctus
ee With the first and second wholly, and a part of the third and fourth segments yellow.....6. varipes
aa Middle and hind femora for the most part yellow or white
b With first, fourth and seventh abdominal segments yellow
3. trifasciatus
bb Abdomen not marked in this manner
c Metatarsus of the fore legs about one half as long as the tibia; abdominal segments with yellow margins.....7. sylvestris
cc Fore metatarsus about two thirds as long as the tibia; abdominal segments with brown posterior bands.....8. debilis

NOTE.—Consult also the auxiliary key containing Walker's species, p.198.

In occasional specimens of some members of this genus the part which is usually yellow is found to be black. In this case, however, the black is shining, and easily contrasts with the velvet black of the other parts.

1. Cricotopus tremulus Linne

1758 Tipula Linn. Syst. Nat. ed. X. p.587, 23
1767 Tipula Linn. Syst. Nat. ed. XII. p.975, 31
1804 Chironomus Meigen. Klass. 1:15, 11
1818 Chironomus Meigen. Syst. Beschr. 1:45, 56
1850 Chironomus Zett. Dipt. Scand. 9:3562, 88
1864 Chironomus Schiner. Fauna Austr. 2:611, 72
1884 Cricotopus Mik. Wien. Ent. Zeitg. 3:202
1899 Cricotopus Johnson, in Smith's Cat'l. Ins. N. J. p.627

Male. Dorsum of the thorax yellow, with wide, posteriorly confluent longitudinal shining black stripes; the pleura sometimes paler with black spot at the base of the wing; the scutel-

lum and the metanotum shining black. The abdomen dull black, basally and at the incisures whitish; anal segment thicker than the preceding one; the forceps white. Head black, the antennae brown, its hairs lighter at the tip. Legs black or brown, anterior coxae, with all the femora at their bases and wide bands on the middle of all the tibiae white; the second and third joints of all the tarsi also white; the fore metatarsus markedly shorter than the tibia. Wings grayish, in certain lights whitish. Halteres white.

Female. Differs from the male in having darker veins in the wings. Length 2 to 3 mm. New Jersey (Johnson).

Translation from Schiner, loc. cit.

2. Cricotopus geminatus Say.

1823 Chironomus Say. Journ. Acad. Nat. Sc. Phil. 3:14, 4
1859 Chironomus Say. Compl. Wr. 2:42, 4
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20
1899 Cricotopus Johnson, in Smith's Cat'l. Ins. N. J. p.627

Thorax fuscous; pleura gray; abdomen white, annulate with black. Humerus gray, the color being a continuation of that of the pleura; pectus livid; feet white; thighs blackish, pale at the base; tibia at base and tip, and tarsi at tip fuscous; abdomen with three broad double bands, formed thus: second segment fuscous with the exception of the posterior margin, third segment fuscous on the basal margin, fourth segment fuscous excepting the posterior edge, fifth segment fuscous on the basal half, sixth and seventh segments entirely fuscous. Length 3-20 of an inch (3.75 mm.). Pennsylvania. Say, loc. cit. New Jersey (Johnson).

3. Cricotopus trifasciatus Panzer

1813 Chironomus Panz. Faun. Germ. p.109, 18
1818 Chironomus Meigen. Syst. Beschr. 1:42, 50
1850 Chironomus Zett. Dipt. Scand. 9:3556, 83
1864 Chironomus Schiner. Fauna Austr. 2:610
1818 Chironomus tricinctus Meigen. Syst. Beschr. 1:41, 49
1850 Chironomus Zett. Dipt. Scand. 9:3555, 82
1864 Chironomus Schiner. Fauna Austr. 2:610
1874 Cricotopus V. d. Wulp. Tijds. v. Ent. 17:132
1877 Cricotopus V. d. Wulp. Dipt. Neerl. p.272, 3
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

(Pl.24, figs. 5 to 10; pl.29, fig.15)

Larva. The larva is yellowish with a brownish or reddish tinge. Some are wholly yellow. Length 4 to 5 mm. This larva differs from all others thus far examined in having a bunch of long, fine, pale yellow hairs (pl.24, fig.9) near each lateral margin

of each of the abdominal segments. The hair tufts are about as long as a single body segment, excepting on segments one and two, where they are shorter or entirely wanting. The head is brown, about 1.5 times as long as wide; antennae, labrum, and epipharynx resembling those shown on pl.25, fig.3; the setae at the apex of the labrum longer than shown here. Mandibles (pl.24, fig.6) with a branched basal and two simple dorsal setae; convex side wrinkled. Maxillae (fig.5) with short palpus, a few papillae and a tuft of mesad projecting setae. The labium (fig.5) somewhat triangular, having a toothed outline as shown in the figure. Prothoracic feet with numerous curved yellowish brown setae. Abdominal setae as described above. The anal prolegs and appendages were destroyed in the few specimens which I have.

Pupa. Length 3 to 4 mm. with black and yellow markings of the adult showing through the integument. Each prothoracic respiratory organ is slender, nearly cylindrical, with smooth surface and rounded ends, its length about 0.25 mm. (fig.8.). The markings of the second, third and fourth abdominal segments as shown in fig.7. The fifth, sixth and seventh are similarly though much less plainly marked. The markings on each segment consist of a large area of very minute caudad projecting setae with a few scattered bare patches, a transverse band of stouter caudad projecting setae near the posterior margin and a band of cephalad projecting setae upon the margin. The latter band is particularly conspicuous on the second segment. The caudal appendage is quite small, and is provided with three pale setae on each posterior angle (fig.10, which also shows the male genitalia of the enclosed imago).

Imago, male. Dorsum of the thorax yellow, with three wide nearly confluent shining black stripes; a spot on each pleuron, the scutellum, sternum and the metathorax also black. The abdomen dull black, the first, fourth and seventh segment with pale yellow cross bands; besides this the posterior margins of the other segments narrowly white; anal segment thicker than the others; forceps white. Head yellow; the palpi black; the antennae brown, its hairs white at the tip. Legs black, the fore coxae, the bases of all the femora, a broad band on each tibia whitish; the fore tarsi black or brown, each middle tarsus with its two basal joints, and each hind tarsus with three basal joints white. Metatarsi of the fore legs of the male only one half as long as the tibiae. Wings whitish.

Female. Abdomen more yellowish; one may say, abdomen yellow with three black fasciae, the two anterior ones each divided by the light colored incisures; the legs also with more yellow.

Length 3 to 4 mm. Schiner, loc. cit. (tricinctus). North America (O. S.); Ithaca N. Y.; Chicago Ill.

"The variety with less black, the thoracic stripes narrower, and the femora only black at the tip, is known as var. trifasciatus". V. d. Wulp (1877).

4. Cricotopus exilis n. sp.

(Pl.24, figs. 1–4; pl.29, fig.16; pl.33, fig.2)

Larva. The yellowish green larvae were taken from the rocky bottom of the shallow but swift, Fall creek water at Ithaca N. Y. Length, 4 to 5 mm. In most of its details the larva is like that shown on pl.25, figs. 12 to 15; but I fail to find a seta on each side at the base of the labium. The lateral surface of the mandible is wrinkled (fig.4), and the curved setae of the epipharynx are more prominent (fig.2); neither are the oblique wrinkles below the teeth of the labium present. Claws of anterior prolegs are coarse and pectinate.

Pupa. The pupa is yellowish with black; the colors of the adult showing through the integument. Length about 2 mm. The markings of the abdominal segments resemble those shown on pl.25, fig.7. The caudal appendages consist of the genital sacks and the three setae at the end of each lateral process of the anal segment.

Imago, female. Head, occiput and upper half of front blackish, the narrow horizontal space above the antennae and face bright yellow; palpi brownish; probocis yellow; antennae brown, the two basal joints yellowish, antennal hairs whitish with an occasional black one. Thorax dusky yellow with three wide shining black stripes, the median one much abbreviated behind, and very narrowly divided posteriorly by a yellow stripe, lateral stripes much abbreviated in front. Pleura yellow with 4 brownish spots or bars at base of wings; pectus yellowish brown; scutellum and metanotum black, the latter with a very narrow yellow median line. Abdomen black and yellow, its dorsum with yellow markings as follows: First segment, narrow basal margin of second, very narrow apical margin of third, all of the fourth and fifth except brownish clouds among the marginal setae, sixth, seventh and eighth faintly at base and apex, and all of anal segment; thus leaving most of the second, third, sixth, seventh and eighth blackish. Genitalia white. Sides of abdomen and venter sordidly yellow, darkened apically. Near the posterior margin of each segment there is a row of black setae, excepting on the first segment, where they are paler colored. Coxae yellowish. The basal one fourth of the fore and basal one half of middle and hind

femora, yellow; the remainder of the femora black, but the line of division not sharply marked. Fore tibiae white with black bases and tips; middle and hind tibiae yellow with black tips, and sometimes bases also. Fore tarsi dark brown; middle and hind ones yellowish brown, each joint darkened apically; fore metatarsus about one half as long as its tibia. Wings bare and spotless, veins yellow. Venation as figured. Halteres yellow.

Male. Like the female but with less yellow; antennae brown with yellow basal joints, hairs pale brownish; genitalia white, length 1.5 to 2 mm. Ithaca, N. Y.

5. Cricotopus bicinctus Meigen.

1818 Chironomus Meig. Syst. Beschr. 1:41, 48
1850 Chironomus Zett. Dipt. Scand. 9:3553, 81
1864 Chironomus Schiner. Fauna Austr. 2:610
1874 Cricotopus V. d. Wulp. Tijds. v. Ent. 17:132
1877 Cricotopus V. d. Wulp. Dipt. Neerl. p.271, 2
1830 Chironomus dizonias Meig. Syst. Beschr. 6:252, 101

Head with the antennae and mouth parts black, the antennal hairs of the male whitish at the tip. Thorax shining black with yellow humeral spots (male) or yellow with wide sometimes confluent longitudinal lines (female); scutellum, metanotum, sternum black. Abdomen black, the first and the fourth segments and in the female the venter also, yellow; the claspers of male snow white. Legs black, fore coxae and the bases of the femora pale yellow; each tibia on its middle section, together with the hind tarsi, except the tips of the joints, white; fore metatarsus one third shorter than its tibiae. Wings whitish, the anterior wing veins and the crossveins pale brown (pl.29, fig.17). Length 2¼ to 3 mm. V. d. Wulp, loc. cit.

Several specimens from Ithaca, N. Y., agree perfectly with this description. In one or two specimens of the male, the yellow humeral spot is indistinct, and in another it is wanting. In some specimens also the hind legs are pale brown, so that the white tibial ring is conspicuous only on the fore legs. In some female specimens the thoracic stripes are brownish.

6. Cricotopus varipes Coquillett

1902 Cricotopus Coq. Proc. U. S. Nat. Mus. 25:93

Larva. Yellowish, or with a greenish tinge. The body tapers both toward the head and caudal end; hence the middle body segments are of greater diameter. Length 6 to 7 mm. Head dark brown, labrum, and epipharynx resembling C. exilis, the

epipharynx with several pairs of rather stout curved spines, besides several small setae; the lateral arms stout, with black apices. The mandibles wholly black, with the lateral surface faintly wrinkled, apical tooth long and slender. Antennae and labrum as with C. exilis and Orthocladius fugax (see pl.25, fig.3). The labium and maxillae as shown on pl.25, fig.22. Each eye consists of two spots nearly in contact, the anterior spot much smaller than the posterior. Setae of the anterior prolegs are coarse, curved, but apparently not pectinate. Posterior appendages resembling those shown on pl.25, fig.6.

Pupa. Colors yellow and black. Length about 5 mm. Respiratory organ not discovered in the single specimen in my possession. Dorsum of abdominal segments uniformly covered with minute spines. Anal appendage like that of C. exilis.

Imago, male. (Pl.29, fig.18.) Head and its members black, hairs of antennae gray; thorax black, mesonotum highly polished; metanotum and scutellum opaque, velvet black; abdomen velvet black, the first two segments and the hind margins of the following two polished yellow; genitalia yellow; femora black, the extreme bases and trochanters yellow, front tibiae and tarsi brown, the former with a broad median white band, other tibiae and tarsi yellow, their apices brownish, legs only pubescent, first joint of front tarsi two thirds as long as the tibiae; wings whitish hyaline; small crossvein slightly darker than the adjacent veins, R_{4+5} almost straight; halteres yellow; length 2.5 mm. Great Falls, Md. Coquillet, loc. cit.

Female. Like the male excepting for sexual characters. The white band on the fore tibiae is nearer the base than the tip, so that the black at the basal articulation is much less than at the apical end. The yellow margins of the third and fourth abdominal segments are quite narrow, and nearly wanting in some specimens. The thorax of the female is more brownish, polished, with pleura and humeri paler, sometimes yellowish. Male and female from Saranac Inn, N. Y., Ithaca, N. Y., Washington State.

7. Cricotopus sylvestris Fabricius

1794 Tipula Fabr. Ent. Syst. p.252, 89
1805 Chironomus Fabr. Syst. Antl. p.47, 46
1818 Chironomus Meigen. Syst. Beschr. 1:43, 53
1850 Chironomus Zett. Dipt. Scand. 9:3558, 85
1864 Chironomus Schiner. Fauna Austr. 2:611
1874 Cricotopus V. d. Wulp. Tijds. v. Ent. 17:132
1877 Cricotopus V. d. Wulp. Dipt. Neerl. p.274, 8
1899 Cricotopus Johnson, in Smith's Cat'l. Ins. N. J. p.627

1826 Chironomus triannulatus Macq. Recueil Soc. Sc. Agri. Lille. p.202, 30
1838 Chironomus Meigen. Syst. Beschr. 7:9, 139
1804 Chironomus vibratorius Meigen. Klass. 1:16, 13

Male. Dorsum of the thorax yellow, with three black stripes, often confluent posteriorly, a spot on each pleuron, the scutellum, sternum and the metanotum shining black. The abdomen black, the base and the incisures yellowish or whitish, the incisures of the fourth and fifth segments usually wider, fascia-like; in fact the markings of the abdomen somewhat variable; the anal segment wide; the forceps white. Head brownish yellow; the palpi darker; antennae brown, its hairs lighter at the tips. Legs black, the fore coxae and femora narrowly white at the bases, each tibia with a wide white or yellow band at the middle, middle femora with the bases widely yellowish, hind femora whitish to the tip; fore tarsi all black or brown; middle tarsi to the third, the hind tarsi to the fourth joint whitish; metatarsus of the fore leg about one half as long as its tibia. Wings whitish; venation as figured (pl.29, fig.19).

Female. The female has the base of the abdomen and the venter yellow, the incisures being whitish. Length 2 to 3 mm. Schiner, loc. cit. New Jersey (Johnson). Some specimens from Chicago, Ill., agree perfectly with the above descriptions.

8. Cricotopus debilis Williston

1896 Orthocladius Will. Trans. Ent. Soc. London. p.275
(Pl.29, fig.20)

Male. Red or reddish yellow. Plumosity of the antennae brownish-black. Mesonotum with three shining brown spots or stripes, narrowly separated. Abdomen slender; each segment with brown posterior band. Legs yellow; front femora brown on distal end; front tibiae light yellow on the proximal half or two fifths, dark brown on the distal portion, about one third longer than the corresponding metatarsi; front tarsi infuscated; the four posterior femora somewhat infuscated distally. Wings hyaline. Length 2.5 to 3 mm. Williston, loc. cit. St Vincent Island.

I have examined a cotype specimen of this species now in the Cornell university collection, and find that it should be included with Cricotopus, instead of with Orthocladius as Professor Williston has it; unless, as the Abbe Kieffer has already pointed out, Cricotopus should be considered as a synonym of Orthocladius.

Genus 40. Camptocladius V. d. Wulp

Tijdschr. v. Entomol. XVI (LXX); XVII, 133

Resembles in most respects Cricotopus; the fore metatarsus is shorter than its tibia; the anal segment of the male is short and broad, the claspers white with white hairs. Legs unicolored, at least not white and black annulate. The halteres of most of the known species are dark. Wings bare, R_{4+5} is bent upwards, sometimes short and ending noticeably before the end of the costa, or running close to it for a distance, the cell R_{4+5} therefore quite broad; the crossvein usually on or proximad of the mid length of the wing; the cubitus forked, the base of the fork usually noticeably distad of the crossvein; the lower branch sinuous (pl.30, figs. 1 to 4). Usually small black species from 1.5 to 3 mm. in length. In other respects like Chironomus.

The larvae of some species have been found in dung. According to Arribalzaga the palpus in Camptocladius has but one joint; in all the species that I have seen there are four joints as in Chironomus.

KEY TO SPECIES OF CAMPTOCLADIUS

Imagines

a Thorax with more or less yellow

b Abdomen and thorax yellow, the latter with three wide blackish lines; wings slightly hairy (Greenl.).....1. graminicola

bb Abdomen pale fuscous, or fuscous

c Anterior crossvein is about one third the wing length from the base; thorax yellow, black-striped; abdomen pale fuscous, more yellowish anteriorly; legs yellow; length 1.5 mm.; female 2. Camptocladius sp.

cc Anterior crossvein is two fifths wing length from the base; abdomen fuscous; length 2 mm.....3. fumosus n. sp.

aa Thorax wholly black

b The crossvein is noticeably proximad of the fork of the cubitus

c Fore metatarsus about one third shorter than its tibia

d R_{4+5} not parallel to the costa, the cell above it quite distinct; wings hyaline, whitish; length 2 mm.....4. aterrimus

dd R_{4+5} long, and curves so as to be nearly parallel to the costa, nearly obliterating the cell above it, especially toward the apex; wing often with a slightly smoky tint; body subshining; no black dash at the base of the wing; length 1.5 mm. 7. minimus

cc Fore metatarsus about one half as long as its tibia

d Fore legs pubescent, middle and hind ones sparsely short pilose; palpi black, thorax black, lightly cinereous, with two rows of yellowish hairs; wings white; length 1.75 to 2.25 mm. (Greenland).....5. pumilio

dd Not as described above

c The posterior branch of the radius ends far before the tip of the wing; wing milk white with a short black bar at its base; antennae of the male with pale hairs; length 1.5 to 2 mm. ..... 6. bysinnus

cc R_{4+5} moderately long; peduncle of the halteres pale; wing milky white; antennae and palpi black (Greenland) ... 8. parvus

bb Crossvein but little if any proximad of the fork of the cubitus. Greenland species

c Middle legs very pilose ..... 9. velutinus

cc Middle tibiae and tarsi nearly bare ..... 10. extremus

NOTE—Compare also the auxiliary key containing Walker's species on p.198

1. Camptocladius graminicola Lundbeck

1898 Chironomus Lundbeck. Vidensk. Meddel. p.278, 59
1902 Camptocladius Kertesz. Cat'l. Dipt. 1:214

Male. Thorax yellow, subshining, with three blackish brown stripes, the middle one posteriorly, the lateral ones anteriorly abbreviated; the pleura yellow, the pectus blackish brown, scutellum yellow, metathorax brown. The abdomen yellow, with yellow hairs, toward the tip sometimes a little darkened. The antennae yellow or pale brown, the palpi yellow. The legs also yellow or pale brown. The halteres yellow; the wings white, the anal lobe moderately produced, obtuse-angled, the veins pale, toward the costal border a little darker. The vein R_{4+5} is straight, the costa is produced a little beyond the tip of the wing, M is almost straight, and runs into the tip of the wing, the cubitus forks under the crossvein, its upper branch enters the wing margin under the tip of R_{4+5}; its lower branch is suddenly deflected. The middle and hind legs are yellow pilose, the fore pair pubescent, the anterior metatarsus a little shorter than the tibia.

Female. Similar to the male, but shorter, and also paler in color; the antennae shorter than the thorax, the abdomen pale yellow, the posterior margins of the segments darker, the wings wider, and finally, the tip of the wing very thinly haired. Greenland. Lundbeck, loc. cit.

The male has a few very indistinct hairs upon its wing near the apex; the hairs upon the wing of the female are rather more conspicuous. Lundbeck, loc. cit.

From this statement it appears that this species might with propriety have been classed with Metriocnemus.

2. Camptocladius sp.

(Pl.30, fig.1)

Female. A single specimen from Lake Forest Ill. resembles the next species, C. fumosus, but differs in being paler or more yellowish, and in having the small crossvein at about one third the wing length from the base. Length 1.5 mm.

3. Camptocladius fumosus n. sp.

(Pl.30, fig.2)

Male. Fuscous. Head and palpi dusky yellowish, occiput grayish; antennae wholly fuscous, the hairs brown. Dorsum of thorax with three wide subshining black or dark brown stripes, the anterior margin, the humeri, the narrow lines separating the dorsal stripes, and the pleura yellow, the scutellum brownish yellow; sternum and metanotum subshining brown or blackish. Abdomen and genitalia uniformly fuscous, with pale hairs. Legs pale fuscous, the bases of the femora yellow. Hairs pale. Front metatarsus about one half as long as its tibia. Wings hyaline with a yellowish tinge; the fork of the cubitus is beyond the crossvein; tip of R_{4+5} is rather close to the tip of the wing and distad of the extremity of Cu_1. Halteres yellow. Length 2 mm. Ithaca N. Y.

4. Camptocladius aterrimus Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:47, 59
1839 Chironomus Staeger. Kröj. Tidsskr. 2:578, 61
1850 Chironomus Zett. Dipt. Scand. 9:3573, 99
1864 Chironomus Schiner. Fauna Austr. 2:612
1874 Camptocladius V. d. Wulp. Tijd. v. Ent. 17:133
1877 Camptocladius V. d. Wulp. Dipt. Neerl. p.276

Velvet black. Antennae, legs and halteres black, plume of the antennae of the male blackish, with a whitish shimmer near the tip. Fore metatarsus about one third shorter than its tibia. Wings whitish, the anterior veins pale brown, the others uncolored, without a short black longitudinal dash at the root of the wing, R_{4+5} gradually bent toward the costa and joining it not far from the end; the posterior branch of the cubitus somewhat less bent than in C. byssinus; length 2.25 mm. Fork of the cubitus noticeably distad of the crossvein. V. d. Wulp, loc. cit. Greenland; Staeger, loc. cit.; Michigan; New Jersey.

5. Camptocladius pumilio Holmgren

1869 Chironomus Holmg., K. Svensk. Vet. Akad. Handl. 8:5, 41
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21
1898 Chironomus Lundb. Vidensk. Meddel. p.276, 57
1902 Camptocladius Kertesz. Cat'l. Dipt. p.1:215

Male. Thorax black, lightly cinereous, subshining, posteriorly with two cinereous, strongly approximated stripes, with yellow pile arranged in two rows. Abdomen black or fuscous black, the base sometimes paler, shining, and with yellow pile. The antennae a little longer than the thorax (not shorter as Holmgren has it). The palpi are black; the legs are more or less brown. The halteres are fuscous black, with the peduncle sometimes sordidly white. The wings are whitish hyaline, the anal

lobes moderately produced, rounded, obtuse angled; the veins toward the costal border are brown, the others thin and pale, both branches of the radius curved; the costa does not extend beyond the tip of the vein R_{4+5}, the media runs into the margin of the wing a little beyond the tip, cubitus forks far distad of the crossvein, its anterior branch ends in the posterior margin of the wing a little proximad of the end of R_{4+5}, the posterior branch is suddenly deflected. The middle and hind legs are sparsely pilose, the fore pair is pubescent; the metatarsus of the fore legs is but little more than one half as long as its tibia.

Female. The antennae shorter than the thorax, the wings shorter and wider, the veins a little more distinct, the media more curved, and the abdomen more robust; everything else as with the male. Length, male and female, 1.75 to 2.25 mm. Greenland. Lundbeck, loc. cit.

6. Camptocladius byssinus Schrank

1803 Tipula Schrank. Fauna Boica. 3:76, 2330
1818 Chironomus Meigen. Syst. Beschr. 1:46, 58
1845 Chironomus Staeger. Kröjer. Naturh. Tids. n. s. 1:352, 7
1850 Chironomus Zett. Dipt. Scand. 9:3572, 98
1864 Chironomus Schiner. Fauna Austr. 2:612
1874 Camptocladius V. d. Wulp. Tijdschr. v. Ent. 17:133
1877 Camptocladius V. d. Wulp. Dipt. Neerl. p.276
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20.
1898 Chironomus Lundb. Vidensk. Meddel. p.273, 53

Velvet black; antennae brownish, plume of the male antenna whitish. Legs blackish brown or pitchy, the hind legs hairy, the fore metatarsus about one half as long as its tibia, the remaining joints in decreasing lengths. Halteres black. Wings milk white, with almost colorless veins excepting at the root of the wing, where there is a short black dash (the basal portion of R); R_{4+5} short, bent toward the costa, which it enters far from its extremity (pl.30, fig.3); the cell R_{2+3} hence quite wide even near its apical end; posterior branch of the cubitus sinuous; fork of the cubitus noticeably distad of the crossvein. Length 1.75 to 2.25 mm. V. d. Wulp, loc. cit. New Jersey. (Johnson, 1899); Greenland (Staeger and Lundbeck); Ithaca N. Y., Michigan, Washington State, Alaska.

7. Camptocladius minimus Meigen

1818 Chironomus Meig. Syst. Beschr. 1:47, 61
1850 Chironomus Zett. Dipt. Scand. 9:3573, 100
1864 Chironomus Schiner. Fauna Austr. 2:612
1874 Camptocladius V. d. Wulp. Tijd. v. Ent. 17:133
1877 Camptocladius V. d. Wulp. Dipt. Neerl. p.277

Black, slightly shining. Antennae black, the plumes of the male dark brown. Legs blackish or pitchy or even yellowish brown; the fore metatarsus one third shorter than its tibia. Halteres black. Wings with a grayish tint; the anterior veins pale brown, the others uncolored; no black dash at root of wing; R_{4+5} bent upwards toward the costa and for a short distance appears to coalesce so that at a casual glance it appears thickened at the end; posterior branch of cubitus not so strongly bent as in byssinus; fork of the cubitus noticeably distad of the crossvein, pl.30, fig.4. Length 1.25 to 1.75 mm. Ithaca N. Y.; Idaho. Larva found in dung (Howard, 1901).

8. Camptocladius parvus Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.275, 55
1902 Camptocladius Kertesz. Cat'l. Dipt. 1:215

Female. Thorax black, somewhat shining, with two sometimes indistinct cinereous stripes, or with three black stripes, the middle one posteriorly, the lateral ones anteriorly, abbreviated. The scutellum is brown, the abdomen is black or fuscous, slightly yellow pilose. The antennae and palpi are dark. The legs are brown, more or less pale. The halteres are dark, the peduncle and the base of the knob sordidly white. The wings are hyaline, in certain lights clear white, pruinose or milky, the posterior margin long ciliated, the anal lobe but little produced, rounded; the veins pale and thin; the radius is somewhat brownish, its anterior branch is short, and runs into the costa near the middle of the wing; its posterior branch is nearly straight, the media curves towards the tip and runs into it, the cubitus forks somewhat distad of the crossvein, its posterior branch is suddenly deflected, the anterior branch and the main trunk are about of equal length. The middle and hind legs are distinctly pilose, the anterior metatarus is one half the length of its tibia. Length 1.5 mm. Greenland. Lundbeck, loc. cit.

9. Camptocladius velutinus Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.274, 54
1902 Camptocladius Kertesz. Cat'l. Dipt. 1:215

This species resembles C. byssinus and C. minimus, but differs from the former in having smoky wings and in being smaller; from the latter in having shorter metatarsi, and from each in its wing venation.

Female. Thorax black, velvety, with two indistinct longitudinal stripes, anteriorly confluent; the abdomen black, velvety, sparsely yellow, pilose; the scutellum brown. Antennae and palpi dark.

The legs black or blackish brown. The halteres are dark, peduncle and base of knob sometimes sordidly white. The wings gray or smoky, the anal lobe moderately produced into an obtuse angle; the veins are thin and pale, the radius is dark, R_{4+5} almost straight, the costa extends a little beyond the tip, the media runs into the tip of the wing, the fork of the cubitus is about opposite the crossvein, its posterior branch suddenly deflected. The middle and hind legs are very pilose, the fore metatarsus is about one half the length of its tibia. Length, 1.5 mm. Greenland. Lundbeck, loc. cit.

10. Camptocladius extremus Holmgren

1869 Chironomus Holmgr. K. Svensk. Vet. Akad. Handl. 8:5, 40
1898 Chironomus Lundb. Vidensk. Meddel. p.276, 56
1902 Camptocladius Kertesz. Cat'l. Dipt. 1:214
1865 Chironomus aterrimus Bohem. Öfv. K. Vet. Akad. Förh. p.575, 21, part

Male. Black, silky. Antennae fuscous black. Wings whitish hyaline, toward the costa subinfuscated; the halteres fuscous black, the legs the same color.

Female. Black, cinereous pruinose. The antennae pilose, the legs fuscous black. Wings somewhat cinereous toward the costa, subinfuscated. Halteres dark.

Male and female. Wings moderately wide, bare, the margins ciliated, the anterior veins stronger and darker than the others, which are pale and thin; there are two distinct spurious costal veins (folds?); a short subcostal vein is usually present. The fork of the cubitus is a little distad of the crossvein, Cu_2 much curved; R_{4+5} ends very near the tip of the wing. The legs of the male have longer pile than those of the female; in both sexes the tibiae and the tarsi of the fore and middle legs nearly bare. The fore tibiae rather long, straight, thickened at the base; fore metatarsus one half or at least one third shorter than its tibia. Length about 1.5 mm. Greenland. Holmgren, loc. cit.

This species is closely related to C. byssinus, but it differs in that the base of the fork of the cubitus lies under the crossvein or but little distad of it. Lundbeck, loc. cit.

Genus 41. Orthocladius Van der Wulp

Tijdschr. v. Entomol. XVI (LXX) and XVII, 132

The larvae and pupae greatly resemble those of Cricotopus, and I have been unable to find a single character which will separate all the species of the one genus from those of the other.

Imago. Resembles Cricotopus and Camptocladius. The fore metatarsus is shorter than the tibia; the legs are not black and white annulate, but nearly uniform in color, either dark or light, in the latter case at most with only dark articulations. Wings bare, R_1 enters the costa beyond the mid length of the wing; R_{4+5} straight or only slightly bent, reaching the end of the costa; crossvein at or even before the mid-length of the wing; the forking of the cubitus usually noticeably distad of the crossvein; the posterior branch straight or gently curved. Genitalia of the type shown on pl.33, fig.1, thus resembling Cricotopus (fig.2). The species usually small, though occasionally of moderate size. In other respects like Chironomus. It will be noted that it does not differ structurally from Cricotopus, differing only in color characters.

KEY TO SPECIES OF ORTHOCLADIUS

Larvae

a Mandible slender with sharp apex; antennae slender; margin of labium irregular, pl.24, fig.12.....5. flavus n. sp.

aa Mandible rather stout; margin of labium with regular teeth

b First laterals of the labium notched on the outer margin; mandible with lateral surface wrinkled.....15. fugax n. sp.

bb First laterals with rounded margins

c Labium on the lower surface with two converging folds, pl.25, fig.14 7. sordidellus

cc Labium without these folds, pl.24, fig.21.....8. nivoriundus

Pupae

a Posterior margin of each abdominal segment with a row of long stout setae, pl.24, figs. 15 and 16.....5. flavus n. sp.

aa The segments without these setae

b Dorsal surface of each segment nearly uniformly covered with minute spines and four pairs of setae; respiratory organ with enlarged apical end, pl.24, figs. 22, 23, 24.....8. nivoriundus

bb Dorsal surface with several transverse patches of minute spines

c The patch covering the center of the disk of each segment largest, pl.25, figs. 7 and 11.....15. fugax n. sp.

cc The middle band consists of two irregular rows of short stout spines 7. sordidellus

Imagines

a Yellowish species. (The females, and the species with brown abdomens, should be sought for in the next section also.)

b Large species 6 mm. in length; yellow; thorax with three dark yellow or brown stripes; abdomen with two brown spots on each segment; male .....1. par

bb Smaller species with pale or yellowish brown abdomen; if not, then abdomen is without distinct spots

c Thoracic stripes black

d Thorax yellow; three vittae on mesonotum, spot below each wing, the pectus and metanotum black, mesonotum highly polished, scutellum brownish yellow; legs brown, fore metatarsus three fourths as long as its tibia; length 2.5 mm.; abdomen pale brown; male. (District of Columbia) .....2. politus

dd Abdomen fuscous black; legs brownish; length 3 mm.; female. (See sordidellus also).....3. frigidus

cc Thoracic stripes brown or reddish

d Abdomen of male with spots on sides of last two segments. Eastern species .....4. oceanicus

dd Abdomen not spotted

e Species having black tibiae and tarsi; length 3.5 to 4 mm. 5. flavus n. sp.

ee Tibiae and tarsi yellow or pale fuscous; smaller species

f Minute yellow species having the crossvein of the wing at the basal third; length .75 to 1 mm.....6. sordens n. sp.

ff Larger species with the crossvein beyond the basal third of the wing; length 2 to 3 mm.....7. sordidellus

aa Blackish or fuscous species

b Wings with an hourglass-shaped spot.....20. clepsydrus

bb Wings not so marked; halteres dark

c Wings slightly smoky in both sexes; for metatarsus over .6 as long as its tibia

d Fore legs of male long haired; thorax of female anteriorly with yellow spots .....19. barbicornis

dd Fore legs of male nearly bare; thorax of female blackish 8. nivoriundus

cc Wings of the male at least, milk white; fore metatarsus about one half as long as its tibia; larva terrestrial...9. stercorarius

bbb Wings not so marked; halteres white or pale

c Legs pale; thorax with three stripes, sometimes indistinct

d The fore metatarsus about one half as long as its tibia; hind tibiae and tarsi scarcely pubescent; length 1 to 1.3 mm. 10. atomarius

dd Fore metatarsus more than one half as long as its tibia

c Thorax yellow with three brown stripes; scutellum yellow, metathorax black; abdomen brownish, or sordidly yellow; legs pale yellow, tipped with black; wings white; length 2 to 4 mm. .....7. sordidellus

ee Usually smaller species (2.5 mm. or less) and otherwise not as above

f Fork of the cubitus under the crossvein

g Fore metatarsus a little shorter than its tibia; thorax, including scutellum and pleura, yellow, the three stripes, pectus and metanotum brown; abdomen fuscous, base and venter yellowish; length 2 to 2.25 mm. (Greenland) 11. difficilis

gg Fore metatarsus 0.6 as long as its tibia; female with a peculiar egg guide, pl.33, fig.7....12. absurdus n. sp.

ff Fork of cubitus distad of crossvein

g R_{4+5} enters the wing margin far proximad of tip of Cu_1; length 1.25 to 2 mm. (Greenland)....13. claripennis

gg R_{4+5} enters wing margin distad of Cu_1

h Small blackish species 1 to 1.5 mm. long; fore metatarsus a little shorter than its tibia.....14. minutus

hh Species 2 to 2.5 mm. long; greenish black; fore metatarsus a little over one half as long as its tibia 15. fugax n. sp.

cc Legs fuscous or black; thorax of male usually not striped; antennae black

d Small black species 1 to 1.5 mm. in length; fore metatarsus a little shorter than its tibia.....14. minutus

dd Larger species 2.5 to 3 mm. in length

e Fourth tarsal joint obcordate, shorter than the fifth. (For description see genus Thalassomyia).....platypus

ee Fourth tarsal joint linear

f Fore metatarsus at least three fourths as long as its tibia

g Anterior tarsi of the male densely hairy; wings white; veins fuscous at base; abdomen subshining black; length 3 mm. .....16. pubitarsis

gg Fore tarsi of the male nearly bare; last three abdominal segments with pale margins; thorax of the female striped. (Compare also sordidellus) 3. frigidus

ff Fore metatarsus not more than two thirds as long as its tibia

g Wings whitish hyaline, a little darker in the female; abdomen fuscous, with fuscous hairs 17. obumbratus n. sp.

gg Wings cinereous; abdomen velvet black with the margins of the segments shining black; fork of the cubitus under or but very slightly beyond the crossvein.....18. basalis

NOTE—Consult also the auxiliary key of Walker's species on p.198

1. Orthocladius par Coquillett

1901 Orthocladius Coq. Proc. U. S. Nat. Mus. 23:608

Male. Yellow, the antennae except the basal joint, apices of front femora, of their tibiae and of their first two tarsal joints, the whole of the remaining joints, also the last two on the other tarsi, brown; a pair of rather large black spots on abdominal segments two to eleven (sic.); mesonotum marked with three darker yellow vittae, hairs of antennae bright yellow, becoming brownish at their apices; front tarsi destitute of long hairs, the fourth joint more than one third as long as the first; wings bare, whitish hyaline, the portion in front of R_1 and R_{4+5} dark gray, the veins brownish; length 6 mm. Riverton, N. J. Coquillett, loc. cit.

2. Orthocladius politus Coquillett

1902 Orthocladius Coq. Proc. U. S. Nat. Mus. 25:93

Male. Head yellow, antennae brown, its hairs yellowish brown; thorax yellow, the three vittae on mesonotum, spot below each wing, the breast and metanotum black, mesonotum highly polished, scutellum brownish yellow, polished, its base opaque blackish; abdomen yellowish brown, becoming darker toward the apex; legs brown, trochanters and extreme bases of femora yellow, middle and hind tibiae and bases of their tarsi dull yellowish, legs only pubescent, fourth tarsal joint slender, as long as the fifth, first joint of front tarsi three fourths as long as the tibiae; wings hyaline, small crossvein not darker than the adjacent veins, R_{4+5} almost straight; halteres yellow; length, 2.5 mm. Washington D. C. Coquillett, loc. cit.; New Jersey, (Johnson).

3. Orthocladius frigidus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.812, 14
1850 Chironomus Zett. Dipt. Scand. 9:3516, 33
1872 Chironomus Holmgr. Öfv. K. Vet. Akad. Förh. 29:105
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20
1898 Chironomus Lundb. Vidensk. Meddel. p.279, 61
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:218

Male and female. Black, subopaque, dorsum of the thorax in the male with a testaceous margin; in the female testaceous with three separated black stripes; the wings cinereous hyaline; the antennae and the legs fuscous. Length 3 mm.

Black, somewhat opaque, and but slightly pubescent. The antennal hairs of the male fuscous black. The thorax pale fuscous underneath, the dorsum with three stripes; these in the male are dilated and confluent, in the female separated, black in color, as is also the metathorax; scutellum yellow. Abdomen of the male narrow, of the female more robust; in both sexes it is black, somewhat hairy; the last three segments with pale apical margins. Wings subhyaline, spotless, the crossvein and the radius subfuscous. Halteres white. The legs wholly fuscous black, tibiae and tarsi slightly paler; somewhat pubescent; fore metatarsus about one fourth shorter than its tibia; fore tarsi bare. Greenland (Staeger, Holmgren and Lundbeck).

According to Lundbeck (1898, p.280) the species which Staeger (1845, p.354) mentions is not O. frigidus but O. pubitarsis Zett.

4. Orthocladius (?) oceanicus Packard

1869 Chironomus Packard. Proc. and Commun. Essex Inst. 6:42
1878 Chironomus Ost. Sack. Cat'l. Dipt. p.21

Larva. It is pale whitish in color, the thoracic rings being tinged on their harder parts with green. It is .22 to .25 of an inch in length. The labium is somewhat triangular and multidentate on the anterior side. This larvae differs from fresh-water larvae of the same genus from Lake Champlain in not having the three-jointed filamentous appendages inserted just above the anal legs. The pair of anal legs is well-developed, and terminates in a single crown of hooks, which can be retracted entirely out of sight. In the fore legs the hooks are much more numerous and arranged in longitudinal rows, about twenty-five in number; those on the upper side of the tip being much the largest, those at the base being minute (pl.34, figs. 17, 18, 19).

Pupa. There are no thoracic filaments, nor is the abdomen terminated with hairs, but the genital armor is well-developed.

Imago, male. The antennae of the male are about as long as the thorax, arising from a knob-like basal joint; the joints are of even length, and from each one arises long delicate hairs, which in our specimens were somewhat appressed to the antennae. But we think it was due to the immaturity of the specimens, and that the hairs stand out as usual in the genus. The lingua is short; palpi well-developed, incurved; eyes large globose, prominent, black. The body is throughout pale testaceous; on the anterior half of the thorax is an oblong light brown spot and an irregular oval spot on each side of the posterior half of the thorax, extending to a point opposite the insertion of the wing. On the under side of the mesothorax is a broad, flattened, corneous area, the fore legs being widely separated from the two posterior pairs. The sides of the thorax are pale with a few dusky spots. The legs are long and very slender, the middle and hind tibiae and tarsi dusky. The wings are white, reaching when folded to the end of the third segment from the end of the body. The abdomen is dusky brown, paler at the tip, with a dusky spot on each side of the last two segments; on the under side is a faint greenish tinge. The tip is flattened, the anal forceps are large with the tip bent in, forming a V, and meeting on the median line of the body. Compared with what is evidently a true Chironomus from Labrador, and other species living in Massachusetts, the thorax of the present species is longer and less globular, the mesosternum presents a longer area, and the antennae are longer and slenderer. The wings are unspotted; there is no transverse costal veinlet at the base of the wing; the costal vein terminates beyond

the middle of the wing, and the first subcostal veinlet terminates on the outer third of the wing, differing in these characteristics from the more typical Chironomi. The abdominal hairs are also shorter.

Female. The female has short 7-jointed antennae, of which the terminal joint is nearly twice as long as the one next to it; they are slightly hairy. The female of our species differs from the other true Chironomi in the shorter and stouter antennae and shorter and smaller palpi. The eyes are much as usual, as is the size of the head in proportion to the thorax. Our female specimen was too incomplete for further description.

The larvae were dredged from Salem harbor. Packard, loc. cit.

The terminology of the wing veins given above is as was given by the author, and therefore does not conform to that used in the other descriptions.

5. Orthocladius flavus n. sp.

Larva. (Pl.24, figs.11 to 17) Yellowish; head yellowish brown; length about 10 mm. Head short, extreme apical margin of labium and posterior margin of head black. Antennae yellow, moderately long, about one fourth or one third the length of the head, slender; apical joints very short and slender (fig.12a). Labrum flap-like, with rounded margin and having a pair of widely separated short yellow setae, the lateral margin fringed. Its under surface (and epipharynx?) differs considerably from the usual type, consisting here of slender caudad projecting lobes and the usual pair of lateral arms with black apices (fig.14). The mandibles (fig.12 md) are yellow, slender, pointed, and only the tip and the teeth black. The inner membranous part has several setae on its cephalic margin. The maxillae (fig.12 mx) are yellow, broad, flattened, each with a short palpus and a number of papillae. At the basal articulation are two branched setae. The hypopharynx (fig.11) is horseshoe-shaped, with papillae on its free margin. The labium (fig.12 l) has several moderately long lateral teeth, several blunt short teeth nearer the central line, and two small sharp ones at the apex. The anterior feet are very short, the yellowish brown claws simple and quite numerous. The body is yellow, moderately stout, with a very few scattered, small, slender setae. Posterior feet are rather short, about as long as the last body segment, claws nearly black, each with two teeth; the outer one slender, curved, the inner one straight, stout, and about one third as long as the outer one, each foot with 16 to 20 claws. The four anal blood gills are as long as the feet, blunt, and white in color. The two dorsal papillae are

dark brown on the under surface and pale above, but little longer than wide, each with 7 or 8 long brown setae at apex.

The larva constructs an oval case (fig.17), about 16 mm. in length, the thick outer coat of which is gelatinous, transparent; the inner tube in which the larva lives is dark brownish green, owing to the material (Spirogyra, etc.) of which it is constructed. When it is disturbed the larva escapes from a hole at the end of the tube. Normally it keeps up a water circulation through the tube by the undulating motion of its body.

Pupa. The pupa resembles very much that of Thalassomyia fusca. It is dusky yellowish brown in color, the ventral surface somewhat lighter. The respiratory organs are slender, about one fifth as long as the thorax, the surface covered with distad projecting scales (fig.13). Upon the dorsal surface of the thorax are several pairs of short black setae. The dorsal surface of all abdominal segments is finely sprinkled with very minute, short, dark setae; the armature of the posterior margin of the seventh segment is shown in fig.15; the margins of the other segments resemble this arrangement, but the spines become gradually shorter cephalad so that on the first segment the spines are replaced by short tubercles. The anal fin is broad and somewhat rounded at the apex, with two pale slender setae near the apex, and with a margin of moderately long, pale, matted hairs (fig.16).

Imago, female. Yellow; antennae, palpi, metathorax, and legs excepting femora, black. Length 3.5 to 4 mm.

Head and proboscis yellow, the latter with black tip; occiput slightly infuscated, palpi deep brown, the basal joint and basal one half of second joint of antenna yellow, the remaining joints deep brown. Thorax deep yellow, with three deep brown lines, the middle one divided by a yellow hair line, a dark brown spot in front of base of wing; pleura and scutellum yellow, pectus and metanotum black. Upon the yellow field of the dorsum and upon the scutellum are several irregular rows of short black hairs. Abdomen pale yellowish brown, disk of each segment a little darker, the posterior margin dorsally with a narrow, ventrally with a wider, yellow fascia. Hairs black. Genitalia yellow and inconspicuous. Fore pair of coxae yellow, middle and hind pair fuscous; all legs black; flexor surface of all femora, except extreme tip, yellow. The extreme basal portion of extensor surface of all femora also yellow. Legs microscopically hairy, fore tibiae with one, and middle and hind tibiae each with two small black spurs; pulvilli and empodium present; fore metatarsus about 0.6 as long as its tibia. The hyaline wings are broad and long, extending beyond the tip of the abdomen, the veins distinct, the anterior

ones yellow, the posterior ones hyaline. Venation as shown in pl.30, fig.6. Halteres cream white; peduncle slightly darker. One specimen bred from larva taken from pond water July 2, Ithaca N. Y.

6. Orthocladius sordens n. sp.

(Pl.30, fig.5)

Female. Yellow; face, proboscis, palpi and antennae yellowish, the palpi and the antennae, except the basal joints, somewhat infuscated. Vertex brownish yellow. Thorax yellow with its three dorsal stripes, metathorax and the sternum reddish. Abdomen yellow, sometimes somewhat infuscated. Fore metatarsus about one third shorter than its tibia; legs yellow, tibiae and tarsi somewhat infuscated. Wings hyaline, anterior veins yellow, posterior one colorless; cubitus forks distad of the crossvein; crossvein at basal third of wing; venation as figured. Halteres yellow. Length $\frac{3}{4}$ to 1 mm. Several specimens, Ithaca N. Y. Two mutilated specimens from South Dakota may also belong here.

7. Orthocladius sordidellus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.814, 26
1850 Chironomus Zett. Dipt. Scand. 9:3521, 38
1864 Chironomus Schiner. Fauna Austr. 2:609
1874 Orthocladius V. d. Wulp. Tijd. v. Ent. 17:133
1877 Orthocladius V. d. Wulp. Dipt. Neerl. p.280, 6
1839 Chironomus variabilis Staeger. Kröjer: Naturh. Tids. 2:571, 44
1850 Chironomus Zett. Dipt. Scand. 9:3519, 36
1878 Chironomus Ost. Sack. Cat'l. Dipt. p.21
1898 Chironomus Lundb. Vidensk. Meddel. p.280, 63
1839 Chironomus varians Staeger. Kröjer's Tids. 2:573, 47
1850 Chironomus Zett. Dipt. Scand. 9:3546, 71

Larva. (Pl.25, figs. 12 to 15.) Yellowish green; head short, brown, with a number of delicate dorsal setae. Each eye consists of two nearly contiguous spots. Antennae (fig.13) short, about three fifths the length of the mandibles, brown in color with apex of each joint paler. Labrum blunt at apex, with a few short marginal papillae and apical setae (fig.12); epipharynx with the usual lateral arms, but the curved setae are very much reduced and modified. Mandibles stout, apical one half, sometimes wholly, black or dark brown, with a long, slender, lateral seta (fig.14 md). The maxilla (fig.14 mx) has a short palpus, some papillae, and a mesad-projecting tuft of pointed filaments; upon its ventral surface a pair of setae, and another larger pair upon the anterior margin of the ventral head sclerite below the base of the maxilla. The hypopharynx has three tufts of papillae upon its margin, one

median and the others lateral. The labium has rounded teeth, the first laterals as long as but not as wide as the middle one; the remaining laterals are more pointed. Viewed from the ventral surface two oblique folds or thickenings in the chitin, one on each side nearly parallel to the toothed margin, may be seen. The claws of the anterior prolegs are coarse and pectinate. The anal prolegs and appendages resemble those shown on pl.25, fig.6. The larvae were taken from a brook near Ithaca N. Y.

Pupa. Yellowish; length 3 to 3.5 mm. Respiratory organs very small. The marking on the dorsum of the abdominal segments (a side view of one is shown in fig.15) consists of four transverse rows on each of segments 2, 3, 4, and 5; and two rows on 1, 6, 7, and 8. The first transverse row on a segment consists of about two or three rows of extremely minute spines; the second an interrupted double row of short but stout spines; the third an irregular triple row near the posterior margin; all these pointing caudad; and finally in the fold of the incisure there is an irregular triple row of much smaller ones pointing cephalad. The second and last rows are wanting on segments 1, 6, 7, and 8. The caudal appendages are like those shown on pl.24, fig.3, for a species of Cricotopus. Larva and pupa have recently been described by Taylor (1903).

Imago. (Pl.30, fig.7) This species resembles Chironomus viridis, but differs in the generic characters. Dorsum of thorax with three dark brown stripes; the metathorax and sternum black; scutellum yellow; the abdomen brownish, the forceps small, the arms rather thick. Antennae, including the basal joints, brown; the hairs pale brownish; palpi brownish red. Legs pale yellow; the extreme tips of the tibiae black; the tarsi dusky; fore metatarsus one third or one fourth shorter than its tibia. Wings whitish. Halteres yellow. Length 2.75 to 4 mm. Greenland, New York, Washington, Texas, Illinois.

Zetterstedt's description of variabilis, which is considered a synonym of the above, is as follows:

Male. Antennae with dark hairs. Head blackish; palpi fuscous. Thorax subopaque, yellow or testaceous, with three black or brown stripes, often distinct, sometimes very wide subconfluent, covering nearly the whole of the dorsum, leaving the humeri pale. Sternum blackish; scutellum more or less yellow; metathorax black. Abdomen narrow, hairy, black, the venter yellowish or testaceous, after death often blackish. The caudal end black, the appendages leaf-like or narrow ovate. Wings white or cinereous hyaline, spotless; halteres pale yellow. Legs nearly bare, brown, fuscous or testaceous, the femur toward the tip often darker, the fore coxae yellow, the tarsi often fuscous, especially the fore pair.

The fore metatarsus about one fourth shorter than its tibia, and about one third longer than the next tarsal joint; tarsi bare. Length 2.5 to 3 mm.

Female. Differs from the male thus: The base of the antenna is often yellow, the thoracic stripes are always distinct, the yellow of the dorsum is usually conspicuous; the abdomen is stouter, less hairy, venter very often conspicuously yellow; the wings cinereous, the wing veins near the costal margin subtestaceous, and lastly, the body is stouter. Length 2 to 2.7 mm.

8. Orthocladius nivoriundus Fitch

1846 Chironomus Fitch. Winter insects of Eastern New York. p.274
1878 Chironomus Osten Sacken. Cat'l. Dipt. N. A. p.21
1898 Orthocladius Johnson. Cat'l. N. J. Dipt. p.627

I formerly erroneously regarded this species as a synonym of Diamesa waltlii.

Larva. (Pl.24, figs.18 to 24). The larvae were collected from pond water on March 28 and the flies emerged the following week. The larva is a pale green creature, somewhat infuscated on the dorsum. Length 6 mm. Head deep brown, short; antennae (fig.19) short, a little less than three fourths as long as the mandible, first joint three fifths of total length, apical appendage of the first joint as long as the second and third joints taken together. Each eye consists of a pair of spots separated by a fine line. Labrum with three pairs of moderate size and about three pairs of small setae on the lower surface; epipharynx with the usual arms and curved pectinate setae. The mandible is stout, with black toothed apex; the maxilla (fig.21 mx) has a small palpus, several blunt setae, some fine hairs and a bunch of mesad projecting, delicate, pointed filaments. The free margin of the labium is provided with black teeth, the middle one broad, with a rounded margin (fig.21 l). The dark thoracic prolegs have the usual slender hairs, but these are apparently either bifid or pectinate. The anal prolegs have sharp bilobed claws. The papillae of the anal hair tufts are short and dark brown in color. Caudad of these is a pair of prominent setae and on the ventral surface cephalad of the anal prolegs is another pair. The anal prolegs are of the usual form. The anal blood gills are present.

Pupa. Black or deep fuscous; abdomen paler. Length about 4 mm. The thoracic spiracles are slender, tubular, with a roughened surface (fig.23); length perhaps a little less than an abdominal segment. The dorsum of each segment, excepting the seventh and eighth, is nearly wholly covered with very short, microscopic spines, besides about four pairs of longer black setae as shown in fig. 22. Sometimes those near the caudal margin

are wanting, or replaced by others nearer the anterior pair. The lateral fins of the seventh and eighth segments have four or five pale, slender filaments; the caudal appendage is fringed with slender hairs, and there are three stout setae at each angle of the apex.

Imago, female. (Pl.30, fig.8) Grayish black. Length 2.5 to 3 mm. Wholly grayish or brownish black, including head with all its parts, thorax and abdomen. Legs pale brown; fore legs nearly wholly bare, middle and hind ones sparsely haired. Fore metatarsus about 0.6 as long as its tibia. Wings slightly smoky hyaline, anterior veins brown, posterior veins hyaline. Venation as shown in figure. Halteres dull black.

Male. Wholly black, very slightly shining. Thorax with a suggestion of three black dorsal stripes; the other parts dull. Abdomen with dark brown hairs. Antennal hairs, black. Legs, dark brown, or almost black, fore tarsi nearly bare. Anal angle of wing prominent; anterior veins brown, wings slighty cinereous. Genitalia black. Length 3.5 mm. In other respects like the female.

This species differs from s t e r c o r a r i u s in having smoky wings in both sexes, abdomen of female darker, and in having an aquatic larva. Ithaca N. Y. The following is a copy of Fitch's description.

Black; poisers obscure brown; wings pellucid-cinereous, their anterior nervures blackish. Length about .15 inch to the tip of the abdomen in the male—females one third shorter.

This species is black throughout, and clothed with fine black hairs. The thorax has three slightly elevated longitudinal ridges immediately forward of the scutel. The wings, when the insect is at rest, are held against the sides of the abdomen, often vertically in the males, but more commonly in the females with their inner margins in contact, thus forming a steep roof covering the back. They are diaphanous, of a cinereous tinge, and feebly irridescent. Their inner margins toward their bases are slightly arcuated. The submarginal or postcostal nervures—those which bound the closed basillary cell, and which proceed from this cell to the margin—are particularly obvious, being of a blackish color, excepting the nerve which proceeds from the inner angle of this cell to the apex of the wing, which, with the nervures inside of it, scarcely differ in color from the surface which they ramify. The poisers are obscure-brownish, truncated at their apices, the capitulum being in the form of a reversed triangle. The abdomen in the female is shorter than the wings, somewhat compressed, approaching to an ovate form when viewed laterally, with the venter

often of a dull brownish tinge; in the males it projects beyond the tips of the wings, is slender, cylindrical, or very slightly tapered towards the tip, with some of the terminal segments separated by a strong contraction.

This is a very common species, appearing upon the snow in the winter season, and upon fences, windows, etc., in the fore part of spring, the males and females being about equally numerous. The beautiful plumose antennae of the former distinguish them at a glance from all other insects abroad at this season. At times they may be met with in immense swarms.

Some specimens of larvae and adults from Gallinas river, Las Vegas N. M. (altitude 6400 feet), do not appear to differ excepting in being a little larger; the genitalia of the male resembles that of Diamesa waltlii. It is possible that on examination of more material the New Mexican form may prove to be a distinct species.

9. Orthocladius stercorarius Degeer

1776 Tipula Deg. Mem. pour serv. a l'hist. d. Ins. 6:388, 22
1818 Chironomus Meig. Syst. Beschr. 1:46, 57
1850 Chironomus Zett. Dipt. Scand. 9:3571, 97
1864 Chironomus Schiner. Fauna Austr. 2:612
1872 Chironomus Holmgr. Öfv. K. Vet. Akad. Förh. p.105
1874 Orthocladius V. d. Wulp. Tijds. v. Ent. 17:133
1877 Orthocladius V. d. Wulp. Dipt. Neerl. p.279, 2
1878 Chironomus Osten Sacken. Cat'l. Dipt. N. A. p.21
1898 Chironomus Lundb. Vidensk. Meddel. p.277, 58
1804 Chironomus chiopterus Meig. Klass. 1:17, 18

Wholly dull black; the antennae blackish brown, the hairs scarcely lighter. Forceps of the male black. Legs blackish brown, pitchy, or occasionally still paler; the fore legs bare; the fore metatarsus only one half as long as its tibia. Wings milky white. The halteres black or brown. The female has somewhat darker wing and lighter abdomen. Length 1.5 to 2.75 mm. Greenland. Holmgren and Lundbeck.

10. Orthocladius atomarius Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3522, 40
1864 Chironomus Schiner. Fauna Austr. 2:609
1884 Orthocladius Mik. Wien. Ent. Zeitg. 3:202
1898 Chironomus Lundb. Vidensk. Meddel. p.283, 68

Resembles O. sordidellus, but is much smaller and the structure of the tarsi is different. Thorax brown, subshining, the dorsum usually yellowish, light brown or testaceous, with three nearly confluent dark stripes; metathorax black. Abdomen

brown, venter lighter, genitalia small. Antennae and its hairs brown. Legs yellow or sordidly white, nearly bare; fore metatarsus only one half as long as its tibia; bare. Wings whitish, immaculate. Halteres white. Length 1 to 1.3 mm. Schiner, loc. cit. Greenland, Lundbeck. Ithaca, N. Y.

11. Orthocladius difficilis Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.282, 67
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:217

Male. Thorax yellow or reddish yellow, with three dark brown stripes, the median posteriorly, the lateral ones anteriorly abbreviated. Scutellum yellow, the metathorax brown, the pleura yellow, the sternum brown; abdomen fuscous black, yellow pilose, the base and the venter yellow. The antennae brown; the palpi sordidly yellow. Legs yellow; the tip of each of the tibiae blackish brown. Halteres yellow; wings almost hyaline, the anal lobe produced, right angled, rounded at the apex; the veins pale and thin, a little stronger and darker at the costal margin. R_{4+5} straight, and enters the margin of the wing a little distad of the Cu_1; the costa is not produced beyond the tip of the wing, the media is straight and enters the tip of the wing, the fork of the cubitus lies below the base of R_{4+5}, its upper branch is a little longer than the main trunk, the lower branch is lightly curved at the tip. The middle and hind pairs of legs are hairy or pilose, the fore metatarsus is a little shorter than the tibia.

Female. Is a little smaller than the male, and the base of the abdomen is but little or not at all yellow; in other respects like the male. Length of male and female 2 to 2.25 mm. Greenland, Lundbeck.

12. Orthocladius absurdus n. sp.

(Pl.30, fig.9; pl.31, fig.8; pl.33, fig.7)

Female. Yellowish brown, including the legs. Genitalia with peculiar clasper-like egg guides. Length 3 mm. Head yellowish brown, including proboscis, palpi and antennae, the basal joint of the last yellow; first joint disk-like, the incisure between the second and third not sharply marked, the seventh elongate (pl.31, fig.8). Thorax, including scutellum, pale yellowish brown; the three dorsal stripes, the metanotum, a spot on the pleura and the pectus darker brown. Abdomen yellowish with a greenish tinge, the dorsum of each segment brownish, except on both sides of each incisure narrowly pale yellow. Hairs pale and sparse. Genitalia with the usual lobes of the female, but in addition a pair of slender arms each with six or seven long setae at the extremity (pl.33, fig.7). Legs uniformly yellowish brown;

fore metatarsus about 0.6 as long as its tibia. Wings hyaline, veins yellow, rather distinct, the anterior veins quite stout (pl.30, fig.9). Halteres pale. One specimen, Ithaca N. Y.

At first I considered this specimen the male of a new genus owing to the peculiar clasper-like appendages of the extremity of the abdomen; but the robust form of the abdomen, the form of the genital lobes, and the antennae, lead me to believe that the specimen is a female.

13. Orthocladius claripennis Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.281, 66
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:217

Resembles O. minutus Zett., but its smaller size, the position of the fork of the cubitus, and the shortness of R_1, distinguishes it.

Male. Thorax fuscous black, with three indistinct black stripes (at least in dried specimens); scutellum brown. Abdomen more or less pale fuscous, with yellow pile. The antennae reddish brown; the palpi yellow. Legs slender, yellow, the tibiae blackish brown at the tip. The halteres white; the wings hyaline and the anal lobe moderately produced, obtuse-angled, the veins slender and pale; R_{4+5} is short, and enters the margin of the wing far proximad of the tip of Cu_1; the media is almost straight, and runs into the tip of the wing; the fork of the cubitus is a little distad of the base of R_{4+5}, its lower branch is almost straight, only at the tip is it curved. The middle and hind legs are pilose; the fore metatarsus is a little shorter than its tibia.

Female. Is shorter and paler than the male, thorax yellow, with three brown stripes, the middle one posteriorly, the two lateral ones anteriorly abbreviated, and the scutellum is yellow; in other respects like the male. Length, male and female, 1.25 to 2 mm. Greenland. Lundbeck, loc. cit.

14. Orthocladius minutus Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3522, 39
1864 Chironomus Schiner. Fauna Austr. 2:609
1884 Orthocladius Mik. Wien. Ent. Zeitg. 3:202
1898 Chironomus Lundb. Vidensk. Meddel. p.281, 65
1898 Orthocladius var. plasensis Strobl. Glasnik Zem. Mus. Bosni i Hercegov. 10:613

Black, or blackish brown, somewhat shining, the last abdominal segment wider than the one preceding it; the forceps small. The antennae, including its hairs, brown. Legs yellowish brown,

the femora somewhat darker; the fore tarsi of the male bare or nearly so, fore metatarsus somewhat shorter than the tibia, the hind tibiae and tarsi thickly haired; wings whitish, spotless. Halteres white. The female has a light spot on each humerus, and the posterior legs have fewer hairs. Length 1 to 1.5 mm. Greenland. Lundbeck.

15. Orthocladius fugax n. sp.

Larva. In little rolls or tubes of debris upon the flat rock bottom of Cascadilla creek (Ithaca N. Y.) little bluish green larvae with dark brown heads were found. These larvae are rather more robust than those of many Chironomids, the middle body segments being fully as wide as they are long. The total length of a full-grown larva is from 3 to 4 mm. Head dark brown, short, with the suture separating the dorsal from the lateral sclerites quite distinct, the dorsal sclerite being elongate-oval, acute-angled at its caudal margin, with three setae upon each lateral margin, the most posterior of these being cephalad of the middle transverse line; opposite this last seta near the suture but upon the lateral sclerite is another seta a little caudad of this, also near the suture there is still another, and on each side near the ventral surface, directly ventrad of the paired eye spot, there is a pair. The pale brown antennae (pl.25, fig.3a) are short, only about one half as long as the mandibles. The latter is stout, its apical half blackened, and with a stout seta on its side. The labrum (fig.3) has a somewhat blunt apex with a few small setae; the epipharynx has the usual pair of arms the ends of which are not conspicuously darkened. The maxilla (fig.2 mx) has a short palpus and a few papillae and a group of mesad projecting filaments. The labium is brown, has a deep margin of black, the middle tooth is rounded, the first lateral has a more or less distinct notch on its lateral edge, the remaining laterals have rounded tips (fig.2 l). Each anterior proleg is provided with perhaps about 50 long and rather coarse pectinate setae (fig.5) and many shorter ones. The posterior legs are each provided with a number of claws, those on the periphery as shown on pl.25, fig.9, those in the middle of the foot as shown in fig.8. The papillae upon which the caudal setae are placed are short and pale in color. The anal blood gills are rather long and prominent (pl.25, fig.6). The diameter of the anterior abdominal segments is considerably greater than that of the posterior.

Pupa. Dark fuscous green. Length 2.5 to 3 mm. Respiratory organ slender, broadened toward the apex, its surface roughened (pl.25, fig.4); its length a little greater than the setae at the

caudal end. A side view of the markings of the second, third and fourth segments is shown on pl.25, fig.7; a dorsal view is given in fig.11. On the sixth, seventh and eighth segments the markings are less conspicuous. The microscopic spines, though short, are rather coarser than in allied species. Besides these spines there is usually on each segment a pair of small setae. The caudal appendage consists of the usual genital sacks and six setae, three on each side of the apex.

Imago. (Pl.30, fig.10.) Greenish black; thorax brown; length 2 to 2.5 mm.

Male. Eyes hairy; head deep brown, face between the bases of the antennae yellowish; proboscis, palpi and antennae pale fuscous, the basal joint of the last deep brown; antennal hairs brownish. Palpus with the first joint about as long as broad, second and third about twice as long as broad, fourth about 1.5 times as long as the second. Dorsum of the thorax and the scutellum dusky greenish yellow, the three stripes of the former and the metathorax deep brown. The pleura and the sternum are somewhat paler in color. Sometimes the scutellum and the space between the dorsal thoracic stripes are pale brown. The dorsal surface of the abdomen is velvet black with a slightly greenish tinge, the first segment wholly and the ventral surface of most of the succeeding segments green, posterior margins of each segment subshining black; the venter of the apical segments blackish. Genitalia pure white, similar to that of Cricotopus shown on pl.24, fig.10. Upon both the dorsal and ventral surface of each abdominal segment there are two irregular transverse rows of black setae, most numerous on the seventh and eighth segments. These are best seen in a balsam mount. Legs, including coxae, sordidly yellow, the knees sometimes widely, and tips of tibiae slightly darkened, moderately hairy; apex of fore tibiae each with one, middle with two short equal spurs; the posterior tibiae each with one long curved spur, one short one, and a row of slender apical setae. The empodium, at least of the hind feet, is curved and pectinate. The wings are hyaline, the veins distinct, pale fuscous, crossvein not clouded; costa with black setae; venation as figured. Halteres pale.

Female. Like the male, differing only in sexual characters; i. e. the more robust abdomen, form of genitalia etc. In both sexes the fore metatarsus is about 0.6 as long as its tibia. The green of the first abdominal segment is not always distinctly visible.

Var. a. Like the foregoing, but with the abdomen, usually including the venter dull fuscous or brown. Numerous specimens. Ithaca N.Y., Chicago Ill.

16. Orthocladius pubitarsis Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.811, 11
1850 Chironomus Zett. Dipt. Scand. 9:3514, 30
1898 Chironomus Lundb. Vidensk. Meddel. p.280, 62
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:221
1845 Chironomus frigidus Staeger (nec Zett.). Kröjer: Naturh. Tids. 1:351, 4

Blackish, subopaque, dorsum of thorax with three black stripes; antennae dark, wings white, legs fuscous testaceous, the fore metatarsus nearly as long as its tibia, fore tarsi of the male distinctly pilose; genitalia small, the appendages somewhat leaf-like. Length of the male 3.5 mm.; of the female 3 mm.

Male and female. The fore metatarsus nearly as long as the tibia, male genitalia subovate, and the densely pilose fore tarsi in the male distinguishes this species.

The head, antennae, and palpi blackish. The thorax blackish, or dull cinereous, subopaque, with black stripes. Scutellum and metathorax blackish. Abdomen of the male slender, linear, subopaque, black, fuscous pilose, the incisures narrowly whitish, subshining, the anal appendage short, subovate, black; of the female stouter, blackish, pubescent. Legs of the male fuscous testaceous, the middle and hind legs pubescent; the fore femora and tibiae bare, fore tarsi distinctly and densely pilose; in the female paler, the articulations narrowly blackish. The fore metatarsus nearly as long as the tibia, the second tarsal joint about one half as long. Halteres pale. Zetterstedt, loc. cit. Greenland, Lundbeck.

17. Orthocladius obumbratus n. sp.

(Pl.30, fig.11)

Male. Grayish black. Face yellowish, eye margin, occiput, antennae excepting the second joint, black; antennal hairs brownish or blackish, proboscis and palpi fuscous. Thorax opaque, grayish pruinose, the humeri and the anterior margin sometimes indistinctly yellowish, scutellum brown or yellowish brown. Abdomen fuscous with fuscous hairs, genitalia small. Legs fuscous, or subfuscous, middle and hind legs hairy; the trochanters and extreme bases of femora yellow; fore metatarsus about two thirds as long as its tibia. Wings whitish hyaline, anterior veins pale yellowish, posterior veins colorless, crossvein not clouded; R_{4+5} almost straight beyond its middle, bowing only a very little toward the costa; venation as figured. Halteres pale yellow.

Female. Somewhat paler than the male; the dorsum of the thorax has three wide blackish stripes, the space between them

and the humeri yellowish. Abdomen blackish or brownish, venter sometimes yellowish. Wings darker than those of the male, the anterior veins dark, R_{4+5} slightly bowed toward the costa beyond its middle. In other respects like the male. Length, male and female, 2.5 to 3 mm.

In immature specimens the legs and particularly the femora are pale. The paler female specimens resemble pubitarsis; the male differs in having no pale margins on the posterior abdominal segments.

Numerous specimens, Ithaca N. Y. Douglass, Alaska.

18. Orthocladius basalis Staeger

1845 Chironomus Staeger. Kröjer: Naturh. Tids. n. s. 1:351, 6
1872 Chironomus Holmgr. Öfv. K. Vet. Akad. Förh. 29:105
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20.
1898 Chironomus Lundb. Vidensk. Meddel. p.279, 60
1902 Orthocladius Kertesz. Cat'l. Dipt. 1:216
1869 Chironomus pavidus Holmgr. K. Svensk. Vet. Akad. Handl. 8:5, 42

The following is Holmgren's description of pavidus:

Male. Antennae a little shorter than the thorax, with fuscous black hairs; the joints somewhat separated. Thorax smooth and wholly shining, excepting the scutellum and metanotum; mesothorax with three stripes, the middle one produced anteriorly, and depressed posteriorly in front of the scutellum, with three short projecting points; scutellum obtuse, elevated and pilose. Abdomen black, subopaque, pale haired, the first segment wholly, the posterior margins of the others shining. Wings narrow, cinereous white or slightly smoky, darker along the costa; crossvein straight; subcosta slightly curved, extending to about the middle of the wing, with two distinctly spurious veins (folds?); fork of the cubitus but little distad of the crossvein. Halteres white or yellowish. Legs black fuscous, the middle of tibiae or before the base very frequently paler; the middle and hind legs sparsely haired; the fore tibiae and tarsi very short haired; fore metatarsus about one third shorter than the tibia. Length 3 mm.

Staeger's description of basalis is as follows:

Female. Head black, front shining. Thorax with humeri and pleura in front of base of wings yellowish, the dorsum with three confluent black stripes; the sternum grayish black. The coxae shining black. Abdomen velvet black, the first two segments yellowish brown (in fresh specimens perhaps pure yellow), and the posterior margins of the following segments shining black. The wings are somewhat darkened; the anterior veins and the crossveins are dark brown and prominent, the other veins are

indistinct; the subcostal vein ends proximad of the fork of the cubitus. The color of the legs is pitchy brown, the base of the fore femora and the middle of the hind tibiae are somewhat yellowish; the fore metatarsus is about one half as long as its tibia, the second tarsal joint is one half as long as the first.

Lundbeck (1898) compared Holmgren's and Staeger's types and declared them identical. Greenland, Washington State.

19. Orthocladius barbicornis Linne

1767 Tipula Linne. Syst. Nat. Ed. XII, 2:974, 25
1805 Chironomus Fabr. Syst. Antl. p.42, 20
1818 Ceratopogon Meig. Syst. Beschr. 1:71, 4
1864 Chironomus Schiner. Fauna Austr. 2:612
1884 Orthocladius Mik. Wien. Ent. Zeitg. 3:202
1805 Chironomus obscurus Fabr. Syst. Antl. p.40, 11
1818 Chironomus Meig. Syst. Beschr. 1:47, 60
1850 Chironomus Zett. Dipt. Scand. 9:3568

Male. Black, or deep fuscous. Head including palpi and antennae black, the hairs of the latter somewhat paler. Thorax with scutellum and metanotum black. Abdomen slender, black, hairy, incisures scarcely paler; caudal appendages short oval, black. Wings white (pale brownish yellow by reflected light), anterior veins testaceous. Halteres blackish. Legs black or pitchy, occasionally paler, uniformly and distinctly hairy; fore femora and tibiae with long, the tarsi with short hairs. Fore metatarsus one fourth to one third shorter than its tibia; the other joints gradually diminishing in length. Length 4 mm. (Zetterstedt in part.)

Female. Thorax anteriorly with yellowish or yellowish brown spots, representing the remains of a pale ground color; the halteres are paler; the wings darker. (Schiner.)

Some specimens from St. Paul Minn., and from Washington State do not differ from my European specimens.

20. Orthocladius clepsydrus Coquillett

1902 Orthocladius Coq. U. S. Nat. Museum Proc. 25:92

Female. Black, the extreme bases of femora and of front tibiae, also the other tibiae except their apices, whitish; mesonotum polished, scutellum and dorsum of abdomen opaque, velvet-like; wings hyaline, each marked with an hourglass-shaped black spot extending from one fourth length of wing almost to apex of upper branch of fifth vein (Cu_1), the constricted portion lying above the forking of the fifth vein (cubitus), the basal expanded portion reaching from fourth vein (media) nearly to hind margin of wing, the apical extending from third vein (R_{4+5}) almost to hind margin

of wing; legs only pubescent, first joint of front tarsi about half as long as the tibiae, fourth tarsal joint rather slender and almost as long as the fifth; length 1.5 mm. Las Vegas Hot Springs, New Mexico. (Coquillett, loc. cit.)

Genus 42. Tanytarsus Van der Wulp

Tijdschr. v. Entomol. XVI (LXX) and XVII, 134

Larva. Small species resembling Chironomus, occasionally red in color, though more often yellowish. Distinguished from allied genera by their long antennae with elongated apical joints, and the frontal protuberances upon which the antennae are mounted. The epipharynx and its appendages resembles that of Chironomus (pl.25, fig.16, and pl.26, fig.14); the maxilla has upon its inner angle one or more spine-like blades which project mesad and cephalad (pl.26, fig.12 mx); the thoracic segments frequently have a few short setae. The ventral surface of the eleventh abdominal segment apparently lacks blood gills.

Pupa. The thorax has a pair of respiratory organs, each of which consists of a central shaft with lateral filaments (pl.26, fig.3). The dorsal surface of the abdominal segments is characteristically marked with hairs and setae (pl.25, figs. 18 and 20, and pl.26, fig.11). The eighth segment has a comb at the caudal end of each lateral fin, and the anal segment has a fringe of hairs forming a paddle (pl.26, figs. 6 and 15).

Imago. (Pl.30, figs. 14 to 21) Antennae of male 14-jointed, long plumose; antennae of female 7-jointed, sparsely haired, first joint in both sexes large and disk-like. Palpi bent, 4-jointed, the last joint usually a little longer than the preceding. The eyes reniform, ocelli wanting. Thorax highly arched, projecting somewhat over the head; metanotum arched. Abdomen of the male slender, the anal segment distinctly separated from the preceding; genitalia long and slender; abdomen of the female shorter and stouter. Legs slender, fore tarsi elongated, the fore metatarsus longer than its tibia; hind legs usually hairy. Wings distinctly hairy; anal angle small; crossvein upon or even proximad of the mid length of the wing; R_{4+5} joins the margin at the extremity of the costa; media simple; the forking of the cubitus is under or just distad of the crossvein; the lower branch is straight or gently bent downwards. Species rather small.

KEY TO SPECIES OF TANYTARSUS

Larvae

a Moderate sized pink or red species, with long filaments at the extremity of antenna, pl.26, fig.1a

b With a hump on dorsal surface of last abdominal segment, most distinct in fresh specimens, pl.26, fig.5.....5. dives n. sp.

bb Without this hump.....3. gmundensis

aa Small yellowish species, antennae without long filaments

b Antennae with two delicate processes with slightly enlarged ends at extremity of the second joint, pl.26, figs. 13–14; larva usually found in its fibrous case, pl.26, fig.9.....13. exiguus n. sp.

bb Antenna with a pointed process at end of second joint, pl.25, figs. 16, 17.....10. dissimilis n. sp.

Pupae

a Lateral fin of the eighth abdominal segment with a simple terminal spur, pl.26, fig.15; second abdominal segment with two small patches of setae near the anterior end and a transverse row near posterior end; pupa in a fibrous case, pl.26, fig.9.....13. exiguus n. sp.

aa Lateral fin of the eighth segment with a comb

b Fourth abdominal segment with two patches of short stout setae on anterior end and a few scattered setae on the surface, pl.26, fig.7 5. dives n. sp.

bb Fourth segment with two longitudinal rows of setae caudad of the anterior patch

c With a transverse row of stout setae on posterior margin of third segment, pl.25, fig.20.....10. dissimilis n. sp.

cc With two patches of setae near posterior margin of the third segment, pl.25, fig.18.....Var. a. of dissimilis

Imagines

a Thorax uniformly black or brown; thoracic stripes wanting or very indistinct

b Legs white or pale yellow; wings white; thorax and abdomen subshining black; male abdominal segments with paler posterior margins; fore metatarsus about 0.15 longer than its tibia 1. obediens n. sp.

bb Legs dusky yellow, fuscous, or black

c Halteres black or dusky; thorax and abdomen subshining black; fore metatarsus about 0.16 longer than its tibia 2. nigripilus n. sp.

cc Halteres pale

d Fuscous, including legs; thorax subshining; fore metatarsus over 0.4 longer than its tibia.....3. gmundensis

dd Smaller dark brown or fuscous green species; fore metatarsus less than one fourth longer than its tibia 4. deflectus n. sp.

aa Thorax green or yellow; if darker, then with distinct stripes
b Dark brown or greenish species, thoracic stripes, usually dark
c Brownish species
d Two mm. or less in length; fore metatarsus but little longer than its tibia.....4. deflectus n. sp.
dd Three mm. or more in length
e Yellowish brown thorax with brownish stripes; fore metatarsus 1.5 times as long as its tibia.....5. dives
ee Fore metatarsus 1.3 times as long as its tibia.....6. T. sp.
cc Greenish species
d Crossvein nearly in the middle of the wing; length 2.5 to 3 mm.; dark green species.....7. junci
dd Crossvein noticeably before the middle of the wing
e Fore metatarsus twice as long as its tibia.....8. pusio
ee Metatarsus of fore legs not twice as long as its tibia
f With dark brown thoracic stripes; length 2 to 3 mm. 9. fatigans n. sp.
ff With yellowish or brown thoracic stripes; length 1.25 to 1.75 mm.....10. dissimilis n. sp.
bb Yellow species; thoracic stripes when present, pale or reddish
c Testaceous; abdomen brown, segments with slightly paler margins; fore metatarsus one fourth longer than its tibia 11. fulvescens n. sp.
cc With yellowish green, or green abdomen
d Fore metatarsus not more than one half longer than its tibia
e Fore metatarsus one half longer than its tibia; yellowish green species, more or less dusky.....10. dissimilis n. sp.
ee Fore metatarsus one third longer than its tibia; paler species; length 2.5 to 3 mm.....12. muticus n. sp.
dd Fore metatarsus more than 0.7 longer than its tibia
e Species 2 mm. or more in length; fore metatarsus twice as long as its tibia.....14. tenuis
ee Species less than 2 mm. in length
f Fore metatarsus about three fourths longer than its tibia, 13. exiguus n. sp.
ff Fore metatarsus about 2.5 times as long as its tibia 15. flavellus

1. Tanytarsus obediens n. sp.

(Pl.30, fig.14)

Male. Subshining black; wings and legs cream white. Head black, palpi, proboscis and antennae with its hairs fuscous, the basal joint of the last yellowish. Thorax subshining black, humeri sometimes slightly yellowish and dorsum with faint indications of two narrow cinereous lines, and three lines of yellow hairs. Abdomen black, the posterior margins of all the segments white or yellow; hairs yellowish; genitalia elongate, yellow. Coxae brown; legs cream white, with white hairs; middle and hind tibiae each with a minute black comb at the tip; fore tarsi

very short-haired, fore metatarsus about one sixth longer than its tibia. Wings cream white, with white veins; venation as figured. Halteres white.

Female. Like the male but with yellow antennae, and the abdomen is nearly uniform in color, paler margins at most but feebly indicated. Length, both sexes, 3.5 to 4.5 mm.

In one male specimen the abdomen is wholly black, and the basal joint of the antenna brown. This fly greatly resembles the female of Chironomus nigricans n. sp., from which it may readily be distinguished by its hairy wings. Numerous specimens; Ithaca N. Y., May, June, July. Washington State.

2. Tanytarsus nigripilus n. sp.

Resembles T. sylvaticus V. d. W., an European species, but differs in having black halteres.

Male. Black, subshining; length 3.5 to 4 mm. Head black; palpi, proboscis and antennae also black, the last with blackish hairs. Thorax wholly subshining black, the dorsum when viewed obliquely from in front with two more distinctly shining black stripes. Abdomen black, subshining, incisures faintly cinereous, hairs black. Claspers slender, brownish. Coxae and legs black, long-haired, particularly the fore tarsi, which are almost bearded; fore metatarsus about one sixth longer than its tibia. Wings hyaline, slightly brownish tinted, anterior veins brownish, posterior ones pale; cubitus forks about under the crossvein. Halteres fuscous or black.

Female. Like the male, but the fore tarsi are less hairy and the halteres are paler. Ithaca N. Y., April. Washington State.

3. Tanytarsus gmundensis Egger

1863 Chironomus Egg. Verh. z. b. Ges. Wien. 13:1109
1864 Chironomus Schiner. Fauna Austr. 2:597, 7
1874 Tanytarsus V. d. Wulp. Tijd. v. Ent. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p.285

(Pl.30, fig.15)

Male. Fuscous. Head, including palpi, proboscis and antennae fuscous, the last with fuscous hairs. Thorax and abdomen wholly fuscous, the last with yellowish hairs; genitalia brown. Legs fuscous, trochanters and bases of femora yellow; short-haired. Fore metatarsus about 1.5 times as long as its tibia. Wings hyaline, veins near the anterior margin yellowish, and others paler. Halteres yellow.

Female. Like the male but with broader wings. Length 3 to 4 mm. I cannot distinguish the American from my European specimens. Ithaca N. Y., Chicago Ill., Washington State. April and October.

4. Tanytarsus deflectus n. sp.

(Pl.30, fig.16)

Female. Brown; abdomen paler. Head, including palpi and antennae brown, second and third joints of the antenna more or less coalescent; rostrum with prominent black setae. Thorax including pleura, pectus, and metanotum, brown; the first with three darker brown stripes; scutellum a little paler. Dorsum of thorax with dark setae. Abdomen uniformly yellowish brown, with black hairs. Legs, including coxae, brownish yellow, the knees slightly darker; quite hairy; fore metatarsus about one fifth longer than its tibia. Wings very hairy, anal lobe not prominent. Halteres white. Length 1.5 to 2 mm.

The respiratory organs of the pupa consist of two slender more or less cylindrical processes armed with one lateral seta at about one third from the apex, and with two or three shorter ones on the apex (pl.22, fig.6). The pupal skin is so mutilated that a further description cannot be given. Several captured and one bred specimen. Ithaca N. Y.

5. Tanytarsus dives n. sp.

Larva. The larvae were found in the sand at the bottom of a pool of water, drainings from a pile of manure. Blood red, with a greenish tinge on the sides, and a prominent hump on the anterior part of the dorsum of the last segment (pl.26, fig.5). Length 6 to 7 mm. Head dark, about 1½ times as long as wide, antennae much elongated, about two thirds as long as the head, or fully as long when they are measured to the tips of the two long filaments of the second antennal segment (pl.26, fig.1). The first joint long and slender, with a slender seta on its side, and a spur at the tip near the base of the second segment; second segment about three times as long as wide, with two long slender filaments at the tip near base of third segment. The third and fourth segments slender, delicate, and inconspicuous; these two taken together less than the length of the second joint. The dorsal sclerite of the head not distinctly separated from the laterals. Upon the dorsal aspect of the head are eight pairs of rather long setae, arranged as shown in fig.1. Each antenna is mounted upon a frontal prominence. There are two distinctly separated eye spots upon each side of the head. The labrum is rather more prominent than usual with Chironomus, with five or six pairs of conspicuous curved subapical setae, a pair of pectinate hairs, several pairs of smaller setae, and an apical pair of short, jointed papillae. The epipharynx resembles that of Chironomus, with its horseshoe shaped ridges, the curved,

overhanging setae, and the transverse comb, the latter having a number of uniform rather long, slender, caudad projecting teeth. Caudad of this are three hand-shaped processes, each with five or six slender, apical, finger-like projections. The lateral arms are prominent, and have enlarged, bifid extemities. Each mandible has a stout subapical and mesad projecting seta, a fringe of subapical hairs, and a slender dorsal, laterad projecting seta (fig.2). The maxilla (fig.4 mx) has a comparatively long palpus (p), a number of small papillae and setae and some mesad curved spines. The hypopharynx has the usual fringe of fine hairs and papillae (fig.4 hy). The labium (l) has about 13 blunt, rounded teeth, the middle one most prominent.

The anterior prolegs have numerous curved, slender, hair-like setae. In nearly mature specimens the thorax is somewhat enlarged. The body has few if any setae. The last segment (fig.5), has a prominent hump near the anterior margin; the posterior prolegs are rather prominent, with a small number of stout claws; each of the dorso-caudal setae tufts is mounted on a prominence. The anal gills are four in number and comparatively short, about twice as long as wide. The larva makes a rough, loose, cylindrical case which partly conceals it.

Pupa. Length 4 to 5 mm. Dusky, with the thoracic respiratory organs each consisting of a single slender shaft, with lateral hairs (fig.3), about as long as a single abdominal segment. The dorsal surface of the abdomen is marked with minute setae, spines, and hairs, as shown in fig.7. This figure shows segments two to six inclusive. The dorsum of the second segment is nearly uniformly covered with fine, very short, miscroscopic spines, four or five pairs of pale setae and the usual chitinous, longitudinally ridged, posterior margin; the third has anteriorly two patches of short black spines, two patches of fine hairs, the rest of its dorsal surface punctate with minute spines, and five or six pairs of pale setae; the fourth, fifth and sixth segments each have two dense patches of short black spines near the anterior margin, sparsely punctate with minute spines, and provided respectively with about eight, seven and five pairs of pale setae. The eighth segment (fig.6) has the usual lateral fins, with its filaments, and has also the combs, each with five or six prominent black teeth. The caudal fin is fringed with long, pale, matted hairs.

Imago, male. Dusky brown, sometimes blackish, legs yellowish brown; length 3.5 to 4 mm. Head, palpi, proboscis and antennae brown, the hairs of the last also brown. Dorsum of thorax gray pruinose, with three subshining brown or black stripes, humeri sometimes a little yellowish. The pleura, sternum and metanotum subshining black, the last with a narrow longi-

tudinal groove; scutellum sordidly yellow or brownish. Abdomen subshining, fuscous, the sides and venter a little paler, the last two or three segments and sometimes the lateral margins of some of the others black; posterior margins of all the segments slightly paler than the rest of the surface. Genitalia brownish, conspicuous, with four pairs of appendages, the outer pair elongate (pl.33, fig.5). All hairs reddish brown. Coxae dark, legs pale brown, extreme tips of middle and hind tibiae black, fore tarsi moderately hairy, middle and hind legs with long but delicate pale brown hairs. Fore metatarsus over 0.4 longer than its tibia. Wings hyaline, costal margin very slightly yellowish, anterior veins pale yellowish, hairs dusky (pl.30, fig.17). Halteres pale.

Female. Like the male but shorter; antennae yellow; wings more densely hairy, and wider in proportion to its length. Length of male 4 mm., of female 2.5 mm. Ithaca N. Y.

6. Tanytarsus sp.

Pupa. Respiratory tubes are very delicate and transparent, each apparently consists of about six long slender filaments resembling those of a Simulium pupa, but they appear to be jointed. The dorsal markings of each abdominal segment consist of an anterior and posterior transverse band of moderately coarse, short spines, a central area of very minute spines, arranged as shown on pl.22, fig.13. The lateral fins of the eighth segment terminate in a spiny spur as shown on pl.22, fig.17. The caudal fringe is as usual.

Imago, male. Head yellowish, including proboscis, palpi, and antennae, the basal joint of the last brown. Thorax reddish brown; the narrow space between the three wide brown dorsal stripes and the scutellum yellowish. Abdomen pale brown, venter more yellowish excepting toward the extremity. Incisures but little if any paler, genitalia and the abdominal hairs pale. Legs, including the apical half of the coxae, whitish, the tip of each middle and hind tibia with a minute black circular comb, one tooth of which is prolonged into a spur. Fore metatarsus about one third longer than its tibia. Wings hyaline, with a slight milky tinge, hairs pale, veins colorless. Halteres pale. Length 3.5 to 4.5 mm.

Female. Like the male but abdomen more brownish. Saranac Inn N. Y.

7. Tanytarsus junci Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:50, 68
1874 Tanytarsus V. d. Wulp. Tijd. v. Ent. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p.287, 9
1898 Chironomus Lundb. Vidensk. Meddel. p.283, 69

1839 Chironomus vernus Staeger (nec Meig.). Kröj. Nat. Tids. 2:580, 70
1850 Chironomus Zett. Dipt. Scand. 9:3579, 108
1864 Chironomus Schiner. Fauna Austr. 2:597

Antennae and palpi brown; antennal hairs of the male pale brown. Thorax dark green, with three broad, black, longitudinal stripes; the sternum and the metanotum shining black. Abdomen dark olive green; the anal segments of the male rounded, shorter and a little broader than the preceding; the claspers as long as the anal segment, broad in the middle, at the base and at the extremity somewhat narrowed; the abdomen of the female is much darker, almost black. Legs variable, blackish brown to yellowish brown; the forelegs long and slender, the fore metatarsus almost twice as long as the tibia (ratio about 4:7); the second tarsal joint about one half as long as the metatarsus; the following joints gradually decreasing in length; hairs of the legs dense and light brown in color. Halteres whitish. Wings hyaline, appearing grayish owing to its hairs; crossvein a little proximad of the mid length of the wing; the fork of the cubitus directly below the crossvein. Male, length 3 to 3.5 mm; female, 2.5 mm. Translation from V. d. Wulp, loc. cit. Greenland. Lundbeck.

8. Tanytarsus pusio Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:256, 117
1850 Chironomus Zett. Dipt. Scand. 9:3583, 115
1864 Chironomus? Schiner. Fauna Austr. 2:597
1874 Tanytarsus V. d. Wulp. Tijd. v. Entom. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p.287, 8

Male. Greenish; thorax with three dark stripes. Head greenish, palpi subfuscous, proboscis yellowish; large basal joint of antenna fuscous, the next few joints yellow, the remaining ones dark; hairs subfuscous. Thorax green with three dorsal stripes, the sternum and the metanotum blackish. Abdomen green, darker toward the caudal end; hairs pale; genitalia prominent, yellowish. Legs greenish yellow, the tarsi and the fore femora and tibiae slightly infuscated, middle and hind legs hairy. Fore metatarsus nearly twice as long as its tibia. Wings hyaline, hairy, veins pale, crossvein proximad of the mid length of the wing; fork of cubitus distad of crossvein. Halteres greenish yellow. Length 2 to 3 mm.

Female. The thoracic stripes reddish or brownish, and the abdomen paler green, otherwise like the male.

Near the anterior margin of each segment of the abdomen in some specimens there is a faint indication of a darker fascia. Male and female specimens; Ithaca N. Y. Brookings, S. D.

9. Tanytarsus fatigans n. sp.

(Pl.30, fig.18)

Female. Head greenish; palpi, and antennae except basal joint, infuscated; proboscis yellow. Thorax greenish, with three dark subshining, brown or blackish stripes; scutellum and pleura pale greenish or yellow; metanotum and sternum blackish. Abdomen grass-green. Legs pale yellowish, slightly infuscated; hairs not long; fore metatarsus over one third longer than the tibia. Wings hyaline, sparsely haired, veins yellowish, venation as figured. Halteres greenish. Length, 2 to 3 mm.

Var. a. One female specimen has darker face, proboscis, and fuscous legs, otherwise agrees with the above description. Taken at same time and place. Ithaca N. Y., April.

10. Tanytarsus dissimilis n. sp.

(Pl.25, figs. 16 to 21)

Larva. Small, white, with brownish tint; found among the trash in the bottom of a muddy pond. Length 3 to 4 mm. Head pale brown, short, with a few dorsal setae. Eye spots, a pair on each side, distinctly separated, antennae nearly double the length of the mandible (fig.17). Labrum with a number of prominent curved setae, some of them pectinate (fig.16 l); epipharynx normal (fig.16). Mandible with a subapical and a lateral seta and a row of fine hairs overhanging the tip. Maxilla with a short palpus, some small papillae and several slender, pointed, mesad projecting lobes (fig.16 mx). The anterior feet are provided with numerous pale curved setae. Thorax with a few pale and very inconspicuous setae. Claws of the posterior prolegs few in number and bilobed. Caudal blood gills four in number and rather prominent. Caudal setae brown; a single shorter and more delicate seta is placed upon each pedicel upon its anterior side.

Pupa. Pale yellowish; length about 3 mm. Thorax with long, slender pointed respiratory organs with hairs upon them. Upon the thorax caudad of the middle are a few rather conspicuous setae. The second, third, fourth and fifth abdominal segments are marked as shown on pl.25, fig.20. The second has two gray triangular pigment spots, their bases near the posterior margin; a few small setae, and the usual transverse posterior row of longitudinal ridges; the third has a broken transverse posterior row of long and prominent black setae, besides a few scattered ones; the fourth has an anterior row which joins the cephalic ends of the two longitudinal rows of long black setae and an anterior median patch of short, stout, black spines, besides several scattered setae; the fifth has two contiguous or nearly contiguous patches near the anterior margin of short stout black spines, and

a pair of discal setae. The lateral fin of the eighth segment terminates in a comb with six or seven short black teeth. The caudal fin is elongate and has the usual fringe of matted hairs.

Imago. Differs from T. exiguus n. sp. in being darker, in having a shorter metatarsus, and in the form of the male genitalia. It is yellowish green, sometimes nearly wholly yellow, more or less infuscated, with three brown thoracic stripes.

Male. Head yellow, including proboscis, palpi and the large basal joints of the antennae; the antennae brown, the basal portion of each hair appearing paler; eyes black. Thorax yellow, slightly infuscated, with a greenish tinge, usually with three more or less distinct buff or pale brown, sometimes darker, stripes. Abdomen green, slender, yellow toward tip; genitalia elongate (pl.33, fig.3), with a dorsal downward curved keel (d), and four pairs of appendages; an elongated pair of lateral lobes (l), a pair of inferior lobes (i) with rounded ends, a pair of short, blunt, superior lobes (s) with much incurved ends, and finally a pair of brush-like appendages (a) projecting mesad from the side of the superior lobes. Legs hairy, uniformly light yellow, sometimes slightly infuscated, tips of middle and hind tibiae each with a pair of minute black combs with an elongate middle tooth, forming a spur. Fore metatarsus about one half longer than its tibia. Wings pale, hairy, the heavier veins close to the anterior margin, all veins pale yellow. Halteres white. Length 1.75 to 2.25 mm.

Female. Like the female of T. exiguus n. sp. but is considerably darker yellow; the thoracic stripes are brown, metathorax brown, abdomen deeper green, the legs pale grayish yellow, sometimes fuscous. In dried specimens all colors appear rather dusky. Length 1.25 to 1.75 mm. Proportion of metatarsus to its tibia like that of the male.

This species was bred a number of times during May, July, and October from pond water. Ithaca N. Y., Ottawa, Canada (from Professor Fletcher).

Var. a. Larva can not be distinguished from the foregoing; the pupa differs in having fewer setae upon the dorsum of abdomen. (See fig.18 for the arrangement of these setae.) This variety has been bred several times. There seems to be no intermediate stage. The adults of this variety seem to be a little more dusky than those of the other.

11. Tanytarsus fulvescens n. sp.

(Pl.30, fig.19)

Male. Testaceous; segments of the abdomen brown with paler posterior margins. Length 3 mm. Head with palpi, probocis, and antennae, and its hairs brownish. Dorsum of the thorax, pleura and scutellum testaceous, with cinereous reflections; the

three dorsal stripes, the sternum and the metanotum brown, the long hairs in the longitudinal rows and those on the scutellum brown. Abdomen brown, with blackish hairs, posterior margins of the segments cinereous white; the genitalia brown, the lateral lobes long and stout. Legs yellowish or testaceous, the tarsi a little darkened, fore legs with short, the middle and hind legs with long hairs. Fore metatarsus about one fourth longer than its tibia. Wings hyaline, appearing somewhat dusky on account of the dark hairs which cover them; veins yellow, margin deeply fringed, venation as figured. Halteres yellow, the knob sometimes slightly infuscated.

Female. Face, basal joints of the antennae and the hairs of the thorax more yellowish; otherwise like the male. Ithaca N. Y. July.

12. Tanytarsus muticus n. sp.

(Pl.30, fig.20)

Male. Yellowish, with three reddish brown thoracic stripes. Head yellowish or greenish, palpi and proboscis yellow; antennae including the hairs and the basal joint brownish. Dorsum of the thorax greenish yellow, with three broad reddish brown stripes, metathorax and sternum brown; scutellum and pleura yellowish. Abdomen greenish, yellow, somewhat infuscated. Hairs pale; genitalia yellow in color and elongate. Legs yellow, somewhat darkened, except the trochanters and bases of femora; the middle and hind pairs longer haired than the fore pair; fore metatarsus one third or one fourth longer than its tibia. Wings hyaline, hairy, veins pale yellow; venation as figured. Halteres yellow. Length 2.5 to 3 mm. Ithaca N. Y.

13. Tanytarsus exiguus n. sp.

Larval case. Numerous fibrous, slender, conical cases are found attached to the rocks in the bottom of shallow brooks in places where the water flows most swiftly during the summer months. Hundreds of these cases may be sometimes found upon a single piece of rock no larger than a man's hand. The cases are slender, conical, with a basal stem and three, or occasionally four, apical filaments; the body is about 3.5 to 4 mm. in length. The color is a pale brown like that of dried grass; the structure is fibrous like that of a Simulium case. The case is reinforced longitudinally by three ribs, the basal prolongations of the filaments; the stem is slightly enlarged at the base, by which it is attached to the rocks. During the early summer most of the cases will be found attached by the stem alone, but later in the season most of them lie flat on the rock and are attached along one side like Simulium pupal cases. Within this case is a small greenish yellow larva, or later,

the tiny pupa. The case is shown on pl.26, fig.9. Ulmer (p.401, 1903) notes a similar structure for an European species.

Larva. (Pl.26, figs.8 to 15). The larva is pale greenish yellow, with a brownish yellow head and elongate antennae; the length is from 3 to 4 mm. Head about 1.5 times as long as wide, with a number of short setae, two at the base of each antenna, two on the front, one mesad, one laterad and one in front of each pair of eyes. There are two eye spots on each side (figs.8 and 14). The antennae (fig.13) are over one half as long as the head, each mounted upon a lateral prominence. The first joint is three times as long as the second, and has a seta on its side a little distad of the middle, and an apical seta 1.5 times as long as the second joint, the latter having two apical setae with rounded ends. The third joint is shorter than the second, the fourth is shorter than the third, the latter has a delicate apical seta. All setae are very pale yellow in color. The labrum is prominent and has two pairs of stout apical setae, one pair of which is curved and elongated (fig.14); besides this there are five or six pairs of smaller lateral setae. The epipharynx is like that of the genus Chironomus, with the usual comb, curved setae, and bifid lateral arms. The mandibles (md) have black tips, the maxillae (figs. 12 and 14 mx) each have a prominent palpus and an elongate mesad projecting process with several blades, very delicate and transparent; the brown labium with its black teeth has an outline as figured (fig.12 l). The prolegs have the usual curved hairs. Each segment of the thorax has a very few scattered setae arranged in two transverse rows. The abdomen is practically devoid of setae. The last segment has the usual dorsal tufts of setae, four short though conspicuous blood gills, and prolegs with their retractile bilobed claws.

Pupa. Pale yellow, with brownish thorax, length about 2.5 mm. The respiratory organs are slender, unbranched, pointed filaments, and bare; about one third the length of the thorax. The second, third, fourth, fifth and sometimes the sixth segment of the abdomen is dorsally marked with a pair of brown spots, upon which are a number of short brown setae, near the anterior margin. The second segment has in addition a transverse row of much finer microscopic spines near the posterior margin, and the usual transverse ridged row upon the posterior edge (fig.11). There are also a very few scattered minute setae. Each lateral fin of the eighth segment has four pale, slender filaments and a single brown apical spur. The caudal fin has the usual fringe of long matted hairs or filaments (fig.15).

Imago, male. Pale yellow, abdomen pale yellowish green. The head with proboscis and palpi pale yellow; antenna somewhat

infuscated, with pale hairs, basal joint yellow; palpi elongate; the eyes conspicuously black, deeply notched. Thorax wholly yellow, with three buff-colored, sometimes indistinct, dorsal stripes. Abdomen quite pale green, very slender and with pale hairs; genitalia (pl.33, figs.4 and 4a) yellow, with four pairs of appendages; an elongate pair of lateral lobes with upturned ends (l), a pair of elongate inferior lobes with rounded ends (i), a pair of short superior lobes with sharp apex and recurved setae (s), a pair of mesad projecting brushlike appendages (a), and finally a curved dorsal keel (d). Legs wholly cream white, tips of middle and hind tibiae each with two tiny black combs, one tooth of each comb being prolonged into a short spur. Legs rather hairy; fore metatarsus nearly three fourths longer than its tibia. Wings white, hyaline, spotless, hairy, margin with long fringe, veins pale. Anterior veins closely crowded towards costal margin, so that the veins are difficult to distinguish. Halteres white. Length 1.5 to 2 mm.

Female. Like the male, differing only as follows: A little shorter, antennae yellow, last joint dark on the lateral surface; abdomen shorter and broader, and often entirely yellow, though sometimes green.

This species is very common among the shrubbery near swift-flowing brooks. Ithaca N. Y.

14. Tanytarsus tenuis Meigen

1830 Chironomus Meigen. Syst. Beschr. 6:255, 112
1850 Chironomus Zett. Dipt. Scand. 9:3581, 113
1864 Chironomus Schiner. Fauna Austr. 2:598
1874 Tanytarsus V. d. Wulp. Tijd. v. Ent. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p. 288, 11
1898 Chironomus Lundb. Vidensk. Meddel. p.284, 70

Pale greenish yellow; dorsum of the thorax with three ferruginous longitudinal stripes; sternum and metathorax also ferruginous. Abdomen of the male very slender, somewhat darkened toward the end, and with long claspers. Antennae yellowish, the hairs appearing lighter; palpi dark brown. Legs pale yellow, the tibiae with black spots at the tip; fore metatarsus twice as long as its tibia. Wings whitish, delicately haired. Halteres pale yellow. Length 2 to 3 mm. Schiner, loc. cit. Greenland. Lundbeck. Specimens from South Dakota and Washington seem to be this species.

15. Tanytarsus flavellus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.816, 41
1850 Chironomus Zett. Dipt. Scand. 9:3584, 117
1864 Chironomus Schiner. Fauna Austr. 2:598

1874 Tanytarsus V. d. Wulp. Tijd. v. Ent. 17:134
1877 Tanytarsus V. d. Wulp. Dipt. Neerl. p.288, 12

(Pl.30, fig.21)

Head, antennae and palpi pale yellow; the antennal hairs of the male brownish yellow; tip of the palpus brownish; eyes black. Thorax, scutellum and metathorax pale yellow, the thoracic stripes pale ferruginous; abdomen pale green; the claspers pale yellow. Legs and halteres pale yellow; fore metatarsus about 2.5 times as long as its tibia. Wings with yellowish tint, pale veins and densely haired. Length 1.25 to 1.5 mm. Translation from V. d. Wulp. Several specimens; Ithaca N. Y.

Tanytarsus (?) sp.

This is a very peculiar little larva from Saranac Inn N. Y. which I doubtfully refer to Tanytarsus, though it may belong to some one of the other genera, Chasmatonotus, Eurycnemus, etc., the larvae of which have not yet been described as far as I am aware.

Larva pale yellowish, length about 2.5 mm. It was found in a little case constructed of grains of sand like those of some caddisflies. A dorsal view of the head is shown on pl.20, fig.10. The head is about 1½ times as long as wide, dark brown in color. There are a number of setae upon the dorsal surface, distributed as in the figure; on the posterior part are about 12 blunt tubercles; at the base of each antenna (a) is a peculiar process with sharp, finger-like projections (b). The antennae are wanting in the single specimen, but judging from the size of the basal articulations they are probably considerably elongated. The labrum possesses prominent setae; the epipharynx is provided with the usual transverse comb, prominent and elongate lateral arms, and curved setae. The mandible is stout and has a prominent lateral subapical seta. The maxilla has a prominent palpus, and the labium has a toothed margin much resembling the one shown on pl.22, fig.7, but with the central tooth somewhat wider and with but 13 instead of 15 teeth. The anterior prolegs have a number of slender, curved, pale setae, not pectinate. Upon the dorsal surface of the thoracic segments are a few long, slender, pale setae. The posterior end of the abdomen is wanting in this specimen.

Genus 43. Eurycnemus Van der Wulp

Tijdschr. v. Entom. XVI (LXX) and XVII, 135

Imago. Head flat in front, covered by the conically produced thorax; front broad, arched; eyes small, reniform; ocelli wanting.

Antennae of the male as long as the head and thorax taken together, 14-jointed, the first joint short, disk-like, the following joints densely plumose; the antennae of the female shorter, 7-jointed, with a few erect hairs. Proboscis short, palpi curved, 4-jointed, the joints of about equal length. Thorax and abdomen hairy, the thorax strongly developed, highly arched, conically produced in front; scutellum and metanotum arched; the sternum projecting almost nipple-like from between the fore and middle legs (pl.34, fig.24). Abdomen cylindrical, the genitalia moderately enlarged; legs thickly haired, the apical ends of the femora and all of the tibiae, particularly the hind ones, thickened; the fore metatarsus about one fourth shorter than the fore tibia, upon each side with long cilia. Wings long and narrow, thickly haired; the anal angle prominent; R_1 and R_{4+5} straight, the latter ending at the end of the costa; crossvein proximad of the mid length of the wing; media unbranched, almost straight and entering the margin immediately below the apex of the wing; the fork of the cubitus distad of the crossvein; both branches bent gently downward; humeral crossveins quite distinct. V. d. Wulp, loc. cit.

KEY TO THE SPECIES OF EURYCNEMUS

Larvae and pupae of the species of this genus have never been described as far as I am aware. Walker's two species may not belong to this genus, but are placed in the following key because of that author's statement "allied to aestivus."

Imagines

a Thoracic stripes and fasciae on abdominal segments brown; length 4 mm. (N. J.) ..... 1. scitulus

aa Thoracic stripes yellow

b Thorax yellow; length 5.5 mm. ..... 2. unicolor

bb Thorax green with orange colored stripes; length 9 mm. 3. lasiomerus

1. Eurycnemus scitulus Coquillett

1901 Eurycnemus Coq. Proc. U. S. Nat. Mus. 23:608

Female. Yellow, the palpi, apices of antennae, four vittae on the mesonotum, a small spot below and slightly in front of each wing, the metanotum, except the upper margin and sides, a broad fascia at base of abdominal segments two to seven; the knees, apices of tibiae and of tarsal joints, dark brown; mesonotum subopaque, front tarsi bare; wings almost wholly covered with brown hairs grayish hyaline, the portion in front of the first (R_1) and third (R_{4+5}) veins pale brown; veins brown; length 4 mm. Habitat: Riverton, New Jersey.

2. Eurycnemus (?) unicolor Walker

1848 Chironomus Walk. List Dipt. Brit. Mus. 1:19
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Female. Body hairy, saffron or pale orange color; feelers yellow; eyes black; legs pale yellow, very hairy; wings colorless, hairy, fringed; veins yellow; poisers pale yellow. Length of body 5.5 mm.; of wings, 9 mm. Nova Scotia. Allied to aestivus.

3. Eurycnemus (?) lasiomerus Walker

1848 Chironomus Walk. List Dipt. Brit. Mus. 1:19
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Male. Wings hairy. Head orange; feelers very downy; their hairs yellow; chest green; the usual three stripes orange colored; abdomen yellow, thickly fringed with hairs along each side; legs yellow, hairy, especially the feet and the tips of the shanks of the fore legs; wings white; veins pale yellow; poisers yellowish white. Length of body 9 mm.; of wings 12 mm. St Martin's falls, Albany river, Hudson's bay.

This species has the chest produced in front like C. aestivus Curtis (=C. hirtipes Macq.) to which it is nearly allied. Walker, loc. cit. C. aestivus, mentioned above, is a synonym of elegans Meig., the type species of the genus Eurycnemus.

Genus 44. Metriocnemus Van der Wulp

Tijd. v. Entom. XVI (LXX) and XVII, 136

Imago. Antennae of the male fourteen-jointed, long and densely plumose; antennae of the female seven-jointed, with a few suberect hairs; in both sexes the first joint is thick, disk-like. Proboscis short, palpi bent, four-jointed. Eyes emarginate, ocelli wanting. Thorax highly arched, more or less produced over the head, sternum strongly arched. Abdomen as in Chironomus; in the male the anal is distinctly separated from the preceding segments, and is provided with a pair of filiform or sometimes widened claspers (pl.33, figs. 6, 8). Legs slender, the hind legs hairy, fore metatarsus shorter than its tibia. Wings hairy, particularly toward the tip; anal angle prominent; the vein R_{4+5} straight and running parallel with the distal end of R_1 and ending a short distance before the tip of the costa; the crossvein is at or even a little proximad of the mid length of the wing; the media is simple; the fork of the cubitus is directly under or even a little

distad of the crossvein; both branches gently bent downward toward the hind margin of the wing; humeral crossvein more or less distinct. Small species usually not exceeding 4 mm in length. V. d. Wulp, loc cit. For a characterization of larva and pupa, see M. knabi.

KEY TO SPECIES OF METRIOCNEMUS

Imagines

a Yellowish species

b Abdomen brown with the incisures more or less yellow

c Fore metatarsus about two thirds as long as its tibia; length 1 to 1.33 mm. ..... 1. nanus

cc Fore metatarsus about 0.8 as long as its tibia; length 3 mm. 2. flavifrons n. sp.

bb Abdomen chiefly yellow

c Large species 6 or 7 mm. in length; thorax yellow with three brownish stripes, and yellow abdomen with brown spots 3. par. n. sp.

cc Smaller species with abdomen nearly uniformly yellow

d Species having wings only sparsely haired; the posterior branch of the cubitus suddenly deflected; abdomen yellow; length 2 to 3 mm. (Greenland). (See Camptocladius gramini-cola)

dd Not as above

e R_{4+5} short, ending far before the tip of the wing; halteres white; length 1.25 to 1.75 mm. (Greenland) 4. debilipennis

ee R_{4+5} extends nearly to the tip of the wing; halteres yellow 5. lundbeckii nom. nov.

aa Grayish, brown, or blackish species

b Thorax with three blackish stripes; ground color yellow; scutellum and metanotum black; legs sordidly yellow or pale fuscous; fore metatarsus about two thirds as long as its tibia; abdomen fuscous; male; length 2 mm. ..... 6. exagitans n. sp.

bb Not as above

c Legs yellow

d Thorax gray with black stripes; abdomen usually with whitish incisures; fore metatarsus nearly as long as its tibia; length 3 mm. ..... 7. incomptus

dd Thorax with yellow ground color and blackish stripes; abdomen with posterior margins of segments yellow; fore metatarsus 0.8 as long as its tibia ..... 2. flavifrons n. sp.

cc Legs black or brown

d Smaller species; length 1.5 to 2 mm.

e Halteres black; dull black, resembling Orth. stercorarius ..... 8. atratulus

ee Halteres white; black; metanotum somewhat polished 11. knabi

dd Larger species; if 2 to 2.5 mm., then velvet black, and otherwise not as above

e Legs long and densely haired; fore metatarsus two thirds as long as its tibia; length 3 to 4 mm. (Greenland)

9. ursinus

ee Legs sparsely haired; male velvet black, female dull; fore metatarsus but little over half as long as its tibia

10. fuscipes

NOTE.—Consult also auxiliary key containing Walker's species, p.198.

1. Metriocnemus nanus Meigen

1818 Chironomus Meigen. Syst. Beschr. 1:50, 69
1874 Metriocnemus V. d. Wulp. Tijd. v. Ent. 17:136
1877 Metriocnemus V. d. Wulp. Dipt. Neerl. p.292, 4

Antennae and palpi dark brown; head and thorax yellowish green, the stripes grayish black, the sternum black. Abdomen brown above with pale incisures, the venter pale yellow. Legs brown. Wings hyaline, the veins somewhat brown. Halteres white. Length, male, 1.33 mm.; female, 1 mm. Meigen, loc. cit.

This species is said to occur in Greenland (Lundbeck). The identification being doubtful, Lundbeck redescribed the Greenland specimens. For these I propose the name lundbeckii (see no. 5.)

2. Metriocnemus flavifrons n. sp.

(Pl.31, fig.1)

Male. Head yellow, proboscis and palpi fuscous, the first joint of the antenna shining brown, the second yellow, the remaining joints and the hairs fuscous. Eyes black. Dorsum of the thorax yellow with three dull, dark brown stripes, sparsely covered with pale hairs. Pleura yellow, scutellum, metanotum, and sternum dark brown. Abdomen dark brown with the posterior one third of each segment yellow; hairs and the genitalia pale brown. Coxae brown, legs yellowish, the tarsi slightly infuscated, legs very sparsely haired, anterior metatarsus about four fifths as long as its tibia. Wings hyaline, hairy, R_{4+5} straight and ends close to the tip of the wing; halteres pale. Length 3 mm.

Female. Like the male, but has wider wings; venation as figured. Ithaca N. Y., July.

3. Metriocnemus par n. sp.

(Pl.31, fig.2; pl.33, fig.6)

Male. Yellow, the antennae except the basal joint, apices of front femora, of their tibiae and of the first two tarsal joints, the whole of the remaining joints, also the last two on the other

tarsi, brown; a pair of rather large black or dark brown spots on abdominal segments two to seven, last segment and the genitalia (pl.33, fig.6) also brown; mesonotum marked with three darker yellow or brownish vittae, the middle one divided, hairs of the antennae brownish; front tarsi destitute of long hairs, middle and hind legs rather hairy, the fore metatarsus about three fourths as long as its tibia, the fourth joint of the tarsi more than one fourth as long as the first; wings hairy, whitish hyaline, the veins yellowish; venation as figured; length 6.5 mm. In one specimen, the one with the darker thoracic vittae, the tips of the middle and hind femora and tibiae are darkened. Axton, N. Y. A female specimen from New Jersey has dark brown thoracic stripes and larger spots on abdomen.

In the paper by Messrs MacGillivray and Houghton in the Entomological News, January, 1903, this fly was identified as Orthocladius par Coq., with the description of which it agrees pretty well except for its hairy wings; the latter fact I had overlooked.

4. Metriocnemus debilipennis Lundbeck

1898 Chironomus Lundb. Vidensk. Meddel. p.286, 76
1902 Metriocnemus Kertesz. Cat'l. Dipt. 1:229

Male. Thorax yellow, with three brown stripes, the median one posteriorly, the lateral ones anteriorly abbreviated, the pleura yellow, the sternum brownish gray, the scutellum yellow, the metathorax brown. Abdomen yellow, with yellow pile. Antennae brown; the palpi sordidly yellow. Legs yellow, the halteres white. The wings whitish hyaline, hairy, the anal lobe but little produced, obtuse-angled, R_1 and R_{4+5} run close together, the latter much shortened, and runs into the costa far before the tip of Cu_1; the media runs into the tip, the base of the fork of the cubitus is a little distad of the base of R_{4+5}, the lower branch is a little curved at the tip. The middle and hind legs are distinctly pilose, the anterior metatarsus is a little shorter than the tibia.

Female. A little shorter than the male, also a little paler, the wings wider and more hairy, the anal lobe more widely rounded; in other respects like the male. Length, male and female, 1.25 to 1.75 mm. Greenland. Lundbeck, loc. cit.

5. Metriocnemus lundbeckii nom. nov.

1898 Chironomus nanus Lundb. (nec Meig.). Viden. Med. p.285

Male. Thorax yellow, in dried specimens often sordidly yellow or fuscous, with three brown stripes, the middle one abbreviated

posteriorly or less distinct, the lateral ones anteriorly abbreviated; the pleura yellow, the sternum brown, the scutellum yellow, the metathorax more or less dilutely brown. Abdomen yellow with yellow pile. Antennae dilutely brown or yellow; the palpi yellow. Legs and halteres yellow. Wings whitish hyaline, moderately hairy, the anal lobe not produced, widely rounded, the veins thin and pale, toward the costa a little stronger, R_{4+5} straight, its apex nearly over the tip of Cu_1; the costa is produced a little beyond the tip of the radius, the media runs into the tip, the posterior branch of the cubitus is suddenly deflected. The middle and hind legs are hairy; the fore metatarsus is a little shorter than its tibia.

Female. Shorter than the male, its thorax a little paler, the wings a little more hairy; in other respects like the male. Length 1.5 to 2 mm. Southern Greenland. Lundbeck, loc. cit.

Var. a. (Pl.31, fig.3.) Some Ithaca specimens agree very well with the above description, but the palpi are pale fuscous instead of yellow, and the sternum is dusky yellow instead of brown. The fore tarsi are slightly infuscated and the posterior branch of the cubitus is suddenly deflected near the end similar to but in less degree than in Camptocladius; in the latter respect it differs particularly from my specimens of M. nanus Meigen. The fore metatarsus is about three fourths as long as its tibia.

Var. b. A specimen from Chicago is wholly yellow; the mouth parts, antennae, three thoracic stripes, a spot on the pleura, the metanotum and sternum, brown. The legs, excepting the coxae and trochanters, somewhat infuscated. Wings hyaline, hairy, anterior veins slightly yellow. Halteres yellow. Length 2.5 mm.

6. Metriocnemus exagitans n. sp.

(Pl.31, fig.4)

Male. Head yellowish, palpi and antennae fuscous, proboscis yellowish; dorsum of thorax with three subshining blackish stripes, the middle one divided; the plura, humeri, and space between the dorsal stripes, yellow; a spot on the pleura, the sternum, scutellum and metanotum subshining black. Hairs on dorsum black. Abdomen wholly fuscous or subfuscous, the hairs and the genitalia somewhat paler. Coxae fuscous, the trochanters and bases of femora yellow; remaining parts of the legs sordidly yellow or pale fuscous; the fore metatarsus about two thirds as long as its tibia. Wings hairy, hyaline, very slightly smoky; R_{4+5} extends nearly to the tip of the wing; costa extends a little beyond the tip of R_{4+5}; venation as figured. Halteres yellowish. Length 2 mm. Two specimens, Ithaca, N. Y.

7. Metriocnemus incomptus Zetterstedt

1838 Chironomus Zett. Ins. Lappon. p.816, 42
1850 Chironomus Zett. Dipt. Scand. 9:3586, 121
1864 Chironomus Schiner. Fauna Austr. 2:607
1898 Chironomus Lundb. Vidensk. Meddel. p.285, 73

Gray; dorsum of the thorax with three black longitudinal stripes, which are often indistinct; the metanotum blackish; the abdomen with pale incisures, at the base sometimes lighter. Head dark; the palpi pale yellow, the antennae testaceous. Legs pale yellow, the coxae and all the articulations brown or at least darker; fore metatarsus but little shorter than its tibia. Wings whitish, spotless, thickly haired; the halteres pale. Length 3 mm. Schiner, loc. cit. (Greenland, Lundbeck.)

The fly described by Van der Wulp as M. incomptus is a synonym of M. modestus Meigen according to Kertesz (1902).

8. Metriocnemus atratulus Zetterstedt

1850 Chironomus Zett. Dipt. Scand. 9:3590, 128
1864 Chironomus Schiner. Fauna Austr. 2:608, 56
1884 Metriocnemus Mik. Wien. Ent. Zeitg. 3:202
1898 Chironomus Lundb. Vidensk. Meddel. p.285, 74

(Pl.31, fig.5, pl.33, fig.8.)

Resembles Orthocladius stercorarius Deg., but differs in having hairy wings. Dull black; abdomen black-haired; the anal segment wider. Antennae and its hairs black. The legs black, the tarsi brown; the fore metatarsus but little more than one half as long as its tibia. Halteres black; wings white, with a darker stripe at its base; delicately haired. Length 1.5 to 2 mm. Schiner, loc. cit. (Greenland, Lundbeck.)

Several specimens from Ithaca, N. Y., agreeing with the above description have the thoracic hairs, especially of the male, pale brown.

9. Metriocnemus ursinus Holmgren

1869 Chironomus Holmgr. K. Svensk. Vet. Akad. Handl. 8:5, 39
1898 Chironomus Lundb. Vidensk. Meddel. p.284, 71
1902 Metriocnemus Kertesz. Cat'l. Dipt. 1:232
1865 Chironomus arcticus Bohem. Öfv. K. Vet. Akad. Förh p.574, 19
1845 Chironomus aterrimus Staeger (nec Meig.). Kröjer. Naturh. Tids. 1:353, 8
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.20

Male. Head black; antennae fuscous black, densely plumose, basal joints of the flagellum stouter. Thorax black, subopaque,

in some lights shining cinereous; black bristled, especially on the sides in front of the wings; scutellum obtuse, black bristled. Abdomen black and black-haired, the anal segment obtuse, flattened (after death), the appendages bearded. The wings cinereous whitish, toward the costa somewhat infuscate, the tip hairy, especially in the radial cell, the remaining surface nearly bare; the posterior margin ciliate. Halteres fuscous black. The legs fuscous black and long-haired except the fore tibiae and tarsi, which are short pilose; fore metatarsus one third shorter than its tibia.

Female. The thorax and abdomen with pale setae, the wings somewhat hairy; the halteres fuscous black or sometimes pale fuscous. Length 3 to 4 mm. Holmgren, loc. cit. (Greenland, Lundbeck.)

Lundbeck (1898 p.284) in a note states, "The wings are very sparsely haired and only toward the apex, the wing of the female being a little more hairy between the branches of the radius than that of the male. The hairs seem to rub off readily, and hence many specimens are found with only a trace."

10. Metriocnemus fuscipes Meigen

1818 Chironomus Meig. Syst. Beschr. 1:49, 65
1850 Chironomus Zett. Dipt. Scand. 9:3578, 107
1864 Chironomus Schiner. Fauna Austr. 2:607
1874 Metriocnemus V. d. Wulp. Tijds. v. Ent. 17:136
1877 Metriocnemus V. d. Wulp. Dipt. Neerl. p.291, 2
1898 Chironomus Lundb. Vidensk. Meddel. p.284, 72
1865 Chironomus carbo Phil. Verh. z. b. Ges. Wien. 15:600, 11
1818 Chironomus picipes Meig. Syst. Beschr. 1:25, 74
1850 Chironomus Zett. Dipt. Scand. 9:3589, 125
1864 Chironomus Schiner. Fauna Austr. 2:612
1878 Chironomus Ost. Sack. Cat'l. Dipt. N. A. p.21

Black, not shining; the anal segment of the male wider than the preceding one. Forceps small, its arms rather robust. Palpi and antennae black, the hairs of the latter sometimes tinged with brown. Legs black, or pitchy; fore metatarsus about one half as long as its tibia. Wings pale brownish or whitish according to the incidence of the light; the hairs dark, more perceptible at the tip; fork of the cubitus distad of the small crossvein. Halteres of the male black, of the female pale. Length 3 to 4.5 mm. Schiner and V. d. Wulp, loc. cit. (Greenland, Lundbeck.)

The species described by Zetterstedt appears to be different, judging from the different relative lengths of fore tibia and metatarsus.

The following is Meigen's description of M. picipes:

Wholly velvet black, including antennae and halteres; only the legs are pitchy, and the wings are grayish, hairy. Length 2 to 2.5 mm. (Greenland, Staeger.)

11. Metriocnemus knabi Coquillett

1904 Metriocnemus Coq. Canadian Entomologist. p.11

Larva. Pale yellow; head dark yellow; eyes, apical half of the mandibles, margin of the labium, dark brown. Claws of both fore and hind prolegs yellow; the dorso-caudal papillae yellow, with about six black setae. Head short, about 1.5 times as long as wide; antennae short like Chironomus; eye spots small, each composed of two confluent pigment spots, the anterior one

Fig. 16 Ventral aspect of larval mouth parts of Metriocnemus knabi x180

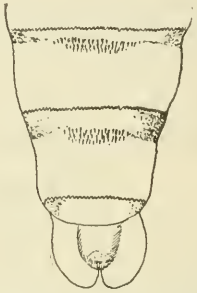

Fig. 17 Dorsal aspect of caudal end of pupa of Metriocnemus knabi x180

smaller. Mouth parts resembling those of Orthocladius, the mesad projecting processes of the maxillae spine-like, the palpi small; the labrum, epipharynx, lateral arms and hypopharynx as in the above-mentioned genus. Labium with the first and second pairs of lateral teeth smaller than the third, fourth and fifth pairs. Anterior prolegs with simple setae (i. e. not pectinate), at the base punctate with groups of minute and very short spines. The claws of the posterior prolegs of two sizes, the laterals slender, the peripherals shorter, stouter and broadened at base. There are four anal blood gills on the 12th segment but the ventrals of the 11th segment appear to be wanting. The dorso-caudal papillae are more than three times their diameter in length, in this respect resembling Tanypus. At the apex of each papilla there are about six long black setae.

Pupa. It resembles an Orthocladius pupa, but the breathing trumpets are apparently wanting. The dorsal posterior margin of each abdominal segment minutely scalloped. Near the anterior

margin of each segment there is a transverse patch of short, fine setae with stout bases. The last segment terminates in a bilobed paddle. The genital sack of the male pupa is longer than that of the female. The specimens of larvae and pupae upon which these descriptions are based were obtained from Mr. Fred Knab.

Imago, male and female. Black, knobs of the halteres whitish, hairs of antennae brown, those of the body yellowish; mesonotum somewhat polished, front tibiae twice as long as the first joint of their tarsi, hind tibiae outwardly fringed with rather long hairs, all tarsi with a short pubescence, but without hairs, the fourth joint slender and longer than the fifth; wings grayish hyaline, densely covered with brown hairs, third vein (R_{4+5}) almost straight; length 1.25 to 2 mm. Westfield, Massachusetts. Description of the imago from Coquillett; loc. cit.

The male genitalia of the type shown on pl.33, figs. 1, 2 and 8.

Genus 45. Scopelodromus Chevrel

Arch. de Zool. Exp. et Gen. 4 ser. 1:1. 1903.

This genus as defined by its author appears to be closely related to or identical with Thalassomyia. Antennae in both sexes seven jointed; the first joint disklike, the second slightly elongate, the third to sixth short and closely sessile, the seventh ovate and slightly enlarged, its apex with a minute button. The palpi are at least as long as the antennae, four jointed; the first joint appearing double, mushroom shaped, its stem obconate, short pubescent, its head flattened, discoidal, pilose and provided with setae; *the second joint is spherical* and with a short pedicel; the third and fourth joints are elongate as in Thalassomyia. The tarsal claws of all the feet of the female, both claws of each hind foot, and the outer claws of the other feet of the male, simple; the inner claw of each fore and middle foot of the male is stouter, flattened, spoon shaped, and from the figure it appears as if the apical margin were scalloped; the empodium pectinate. The apex of the abdomen of the female is provided with a pair of jointed appendages; the basal joint of each is slender, the second short, obconate, the third disklike, thin, its plane vertical, oval in outline, its apical margin notched; male genitalia resembles that of Thalassomyia fusca. The form of the head, eyes, thorax, abdo-

men, legs, etc. like Thalassomyia. The fore metatarsus is shorter than its tibia, the fourth tarsal joint on all feet of both sexes obcordate, shorter than the fifth; apex of each tibia with two delicate setae; wing venation as in Thalassomyia, the surface under a low power, appears punctate, under high power, short haired.

The larvae were found upon the rocks among the algae at the seacoast, in the Bay of Saint Malo, Brittany. They are described as green in color, ten or twelve mm. in length. The labium has 14 teeth, the two median, larger than those adjacent; in other respects it does not appear to differ from Thalassomyia fusca. The eggs are oval, measuring 200 to 280 microns, and are deposited singly or in little groups, embedded in a jellylike substance.

The type species and the only one described, is S. iscmerimus Chevrel. From Chevrel's description it will be seen that the female differs from Thalassomyia fusca and congregata in the form of the first and second palpal joint and in color characters. Whether it differs in any particular from T. frauenfeldi I am unable to say since Schiner's description does not mention the form of the palpal joints. The male differs from the male of T. fusca in the number of antennal joints, the form of the first two palpal joints and in the formation of the tarsal claws. The males of T. congregata and frauenfeldi have not been described as far as I am aware.

Genus 46. Macroptilum Becker

Mitteilungen d. Zool. Museum. Berlin No. 2. 2:77

Since the foregoing pages were written it was found that this genus, which was recently described by Becker, was overlooked. The type of the genus and the only described species is Macroptilum nudum Becker, from Egypt.

Errata

P. 142, line 14, for "pulcripennis" read "pulchripennis."

ADDENDA

A number of larvae representing three species were taken by Mr. R. E. Richardson from the stomach of a shovel-nose sturgeon. The fish was caught June 1904 in the Mississippi river near Grafton, Illinois. All the specimens were in rather poor condition, but they nevertheless exhibit peculiar characters which prevent placing them in any of the foregoing genera. Two of them (A and B) are certainly members of the group Chironomus, and possibly belong to the genus Tanytarsus. The third one is a Chironomid having both Chironomus and Ceratopogon affinities.

Chironomus sp. A.

Length 7 mm. Body stout, greenish in color; head brown, small, only about half as wide as the thoracic segment, tapering; eyes each consisting of two small distinctly separated pigment spots,

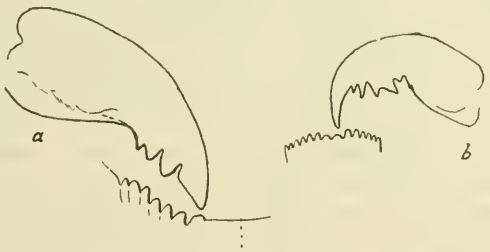

Fig. 18 Mandible and labium; larva A x400; larva B x180

situated as far cephalad as the margin of the labium. Anterior prolegs with rather numerous curved setae; posterior prolegs slender with a few bilobed pale brown claws. Antennae long, more than half the length of the head, three-jointed, besides the short basal prominence and two slender apical processes; first joint long, second very short, no longer than wide, third about $\frac{2}{3}$ as long as the first. Mandible stout, darkened apically, with moderately stout teeth; labium with margin concave (see figure). Teeth arranged on each side of the center line, the middle section toothless. There are four anal blood gills but there are none on the ventral surface of the eleventh segment; above the superior pair of anal gills are two stout setae; the dorso-caudal papillae are short, each with a tuft of long pale brown setae.

Chironomus sp. B.

Length 6.5 mm.; color greenish; head brown, rectangular, nearly as wide as the first thoracic segment; eyes as in species "A" described above; antennae long, about half as long as the head, three-jointed, not counting the basal prominence and the apical processes; the first and third joints about of equal length, the middle one about $\frac{2}{3}$ as long as the first. Mandible stout, black tipped, the teeth very prominent; labium rounded, teeth small, the first laterals shorter than the second (fig.18B). Fore prolegs with rather short spines; posterior prolegs not visible and probably destroyed. Caudal papillae and anal blood gills present, but not in sufficiently good condition to describe; ventral blood gills wanting.

Chironomid sp. C.

Length 9 mm. Body stout, green in color; head very small, slender and tapering, yellowish; mouth parts resembling those of Ceratopogon; mandibles small, slender, sharp, and apparently move in a nearly vertical plane. On the convex surface of the mandible is a slender spine. The antennae are long and slender, nearly as long as the head, the articulations indistinct, apex with slender processes. Eyes each consisting of a pair of pigment spots situated on the posterior fourth of the head. Margin of the labium apparently straight, toothless, not blackened, bounded on each side by the fan-shaped membrane which is present in Chironomus, the striations particularly distinct. Anterior prolegs prominent, with comparatively few, long, slender, curved, yellow, but not pectinate claws. These claws are not hair-like as in Chironomus, but more like the claws of the anterior prolegs of Ceratopogon sens. str. Posterior prolegs long and very slender, claws few in number and very small, very much smaller and shorter than those of the fore legs. Dorso-caudal papillae with its setae and the anal blood gills present. The poor condition of the specimens renders further description impossible.

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Articles marked with an asterisk (*) relate to the biology of the species. For a more complete bibliography of the European species (Imagines) see Kertesz's Catalogus Dipterorum I, p. 156 to 249.

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EXPLANATIONS TO THE PLATES

PLATE 1

The bull-frog, Rana catesbiana Shaw. Photo by Dr. J. L. Hancock

PLATE 2

Hemerobian wings

1 Wings of Hemerobius tutatrix Fitch.
2 Wings of Spadobius occidentalis Fitch.

PLATE 3

Hemerobian wings

1 Wings of Micromus insipidus Hagen.
2 Wings of Micromus jonas sp. nov.
3 Wings of Palmobius amiculus Fitch.

PLATE 4

Mayflies

1 Wings of subimago of Baetisca obesa Say. showing color pattern: 1, 2, 3, anal veins.
2 Lateral view of nymph of Baetisca obesa Say
3 Wings of imago of Ecdyurus maculipennis Walsh
4 Wings of imago of Heptagenia interpunctata Say

PLATE 5

Chirotenetes

1 Female imago of Chirotenetes albomanicatus sp. nov.
2 Wings of subimago of same
3 Lateral view of nymph of same
4 Dorsal view of nymph of same

PLATE 6

Chirotenetes

1 End of male abdomen of Chirotenetes albomanicatus sp.* nov. viewed from below; f, forceps; m, rudimentary median caudal seta
2 Labrum of nymph of same species
3 Labium of nymph of same
4 Mandible of nymph of same
5 Maxilla of nymph of same, with suboval gill tuft attached
6 Base of antenna of nymph of same
7 Fore leg of same, with coxal gill tuft attached
8 Hind leg of same
9 Claw of hind tarsus of same
10 Gill lamella of the fourth abdominal segment with gill tuft attached to its base on the under side

PLATE 7

Mayfly nymphs (photographed from alcoholic specimens)

1 Nymph of Ameletus ludens sp. nov.
2 Nymph of Choroterpes basalis Banks
3 Nymph of Ecdyurus maculipennis Walsh

*White fore torsi accidentally cut away in cutting out the back-ground.

4 Ventral view of nymph of Rhithrogena elegantula Etn.?
5 Dorsal view of the same
6 Ventral view of Iron sp? from Coy Glen near Ithaca
7 Dorsal view of the same

PLATE 8

Choroterpes and Ameletus

1 Wings of imago of Choroterpes basalis Banks
2 Abdominal appendages of the male imago of same, from below
3 Labium of nymph of the same
4 Maxilla of nymph of the same
5 Labrum of nymph of the same
6 Mandible of the nymph of the same
7 Gill filament of the first abdominal segment of the same
8 Gill lamellae of the fourth abdominal segment of the same
9 Venation of the wings of Ameletus ludens sp. nov.

PLATE 9

Mayfly nymphs (photographed from alcoholic specimens)

1 Three nymphs of Ephemerella excrucians Walsh, showing differences in depth of coloration; the left front foot of the left hand specimen has been lost and is regenerating
2 Nymph an unknown Ephemerella from Pecos New Mex.
3 Dorsal and ventral views of nymphs of Heptagenia interpunctata Say
4 Dorsal and ventral views of nymphs of Heptagenia sp? no. 3. from Ithaca N. Y.

PLATE 10

Drunella and Ephemerella

1 Venation of fore wing of nymph of Drunella grandis Etn.?
2 Venation of hind wing of same
3 Face of the nymph of same (male)
4 Claw of hind tarsus of same
5 Claw of hind tarsus of Ephemerella bispina sp. nov.
6 Lateral view of nymph of Drunella grandis Etn?, legs removed
7 Dorsal view of abdomen of nymph of Ephemerella sp? from Richfield Springs N. Y.
8 Male abdominal appendages of Ephemerella excrucians Walsh
9 Male abdominal appendages of Ephemerella sp? from Pecos N. Mex.
10 Male abdominal appendages of Ephemerella bispina sp. nov.

PLATE 11

Leptophlebia and Caenis

1 Venation of wings of Leptophlebia praepedita Etn.
2 Abdominal appendages of male of same, drawn from mounted slide, the ventral processes of the inner appendages somewhat turned aside by pressure of the coverglass
3 Venation of the wing of Caenis hilaris Say
4 Venation of the Wing of Caenis diminuta Walker

5 End of male abdomen of same from below
6 End of male abdomen of Caenis hilaris Say, from below. 3 and 4 to same scale; 5 and 6 to same scale

PLATE 12

Nymph of Polymitarcys albus Say

DRAWINGS BY W. E. HOWARD

1 Dorsal view of the nymph
2 Mandible
3 Maxilla
4 The right fore leg
5 Labium
6 Antenna
7 A gill from the fourth abdominal segment
8 Labrum

PLATE 13

1 Apex of abdomen of Hydroptila consimilis from beneath
2 Apex of abdomen of Hydroptila consimilis from above
3 Apex of abdomen of Hydroptila consimilis from side
4 Another view of penis of Hydroptila consimilis
5 Apex of abdomen of Hydroptila delineatus from beneath
6 Apex of abdomen of Hydroptila delineatus from side
7 Apex of abdomen of Hydroptila delineatus latero dorsal aspect
8 Apex of abdomen of Hydroptila spatulata from beneath
9 Dorsal of plate of Hydroptila spatulata from above (not quite satisfactory)
10 Apex of abdomen of Hydroptila spatulata from side
11 Apex of abdomen of Hydroptila hamata from beneath
12 Apex of abdomen of Hydroptila hamata from above
13 Apex of adbomen of Hydroptila hamata from side

PLATE 14

14 Apex of abdomen of Ithytrichia clavata from beneath (not satisfactory)
15 Apex of abdomen of Ithytrichia clavata from side
16 Apex of abdomen of Ithytrichia confusa from above
17 Apex of abdomen of Ithytrichia confusa latero ventral aspect
18 Apex of abdomen of Orthotrichia brachiata from beneath
19 Apex of abdomen of Orthotrichia brachiata from side (not satisfactory)
20 Apex of abdomen of Oxyethira coercens from beneath
21 Apex of abdomen of Oxyethira coercens from above
22 Apex of abdomen of Oxyethira coercens from side
23 Apex of abdomen of Oxyethira viminalis from beneath
24 Apex of abdomen of Neotrichia collata from beneath
25 Penis of Neotrichia collata
26 Apex of penis of Neotrichia collata, another view
27 Fore wing of Neotrichia collata
28 Hind wing of Neotrichia collata

PLATE 15

29 Head of Neotrichia collata
30 Apex of abdomen of Neotrichia collata from above
31 Apex of abdomen of Hydroptila perdita from beneath
32 Apex of abdomen of Hydroptila perdita from above
33 Apex of abdomen of Hydroptila perdita from side (somewhat crushed)
34 Penis of Hydroptila perdita
35 Apex of abdomen of Ithytrichia clavata from above
36 Dorsal plate of Hydroptila consimilis (dry example from Belfrage Texas)
37 Apex of abdomen of Oxyethira dualis from beneath
38 Apex of abdomen of Oxyethira dualis from above
39 Apex of penis of Oxyethira dualis

PLATE 16

Chironomus sp.

1 Adult male. x6
2 Pupa
3 Head of adult female
4 Larva (the second and third segments coalescent)
5 Frontal aspect of larval head

PLATE 17

Ceratopogon sens. lat.

1 Larva. x6
2 Hypopharynx of larva. x100
3 Caudal end of larva. x100
4 Ceratopogon sens. str. Larva. x10
5 Ceratopogon sens. str. Body segment of larva. x40
6 Ceratopogon sens. str. Mandible of larva. x180
7 Ceratopogon sens. str. Thoracic prolegs of larva. x400
8 Ceratopogon sens. str. Claw of hind proleg of larva. x400
9 Ceratopogon sens. str. Dorsal aspect of pupa. x15
10 Bezzia sp. Dorsal aspect of labium, maxilla and its palpus
11 Bezzia sp. Ventral aspect of pupa
12 Bezzia sp. Thoracic respiratory organ of pupa. x100
13 Brachypogon wing
14 Ceratopogon sens. str., wing
15 Bezzia wing
16 Sphaeromyas wing

PLATE 18

Ceratopogon sens. lat.

1 Dorsal aspect of labrum of larva; a, antenna; b, papilla. x400
2 Dorsal aspect of labium and maxilla of larva; p, palpus. x400
3 Lateral aspect of head of larva; m, mandible; a, antenna. x100

Bezzia setulosa

4 Mandible of larva. x400
5 Hypopharynx of larva. x400
6 Dorsal aspect of labium of larva. x400

Ceratopogon sens. str.

7 Foot of imago

Culicoides sp.

8 Foot of imago

Bezzia setulosa

9 Respiratory organ of pupa. x100
10 Dorsal aspect of pupa. x15
11 Ventral aspect of pupa. x15
12 Fore femur of imago. x40

Sphaeromyas argentatus

13 Fore fifth tarsal joint of female imago. x40
14 Hind fifth tarsal joint of female imago. x40

Bezzia setulosa

15 Antenna of male imago. x40
16 Antenna of female imago. x40

PLATE 19

Ablabesmyia flavifrons

1 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium. x100
2 Respiratory organ of the pupa. x50

Procladius pinguis

3 Respiratory organ of pupa. x50
4 Caudal appendage of pupa. x15

Ablabesmyia sp.

5 Labium of larva. x180

Ablabesmyia dyari

6 Caudal appendage of pupa. x15
7 Respiratory organ of pupa. x50

Ablabesmyia monilis

8 Pupa. x5
9 Larva. x5

Procladius adumbratus

10 Caudal end of larva. x50

Ablabesmyia monilis

11 A pale claw of the posterior proleg of larva. x100
12 A dark claw of the posterior prolegs of larva. x100
13 Respiratory organ of pupa. x40
14 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium; h, hypopharynx; x, lateral process. x100
15 Caudal appendage of pupa. x40

Ablabesmyia fastuosa

16 Mandible of larva. x100
17 Antenna of larva. x100
18 Respiratory organ of pupa. x40
19 Caudal appendage of pupa. x40

PLATE 20

Procladius adumbratus

1 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium; h, hypopharynx; x, lateral process. x180
2 Slender claw of posterior proleg. x180
3 Stout claw of posterior proleg. x180
4 Caudal appendage of pupa. x40
5 Respiratory organ of pupa. x100

Ablabesmyia carnea

6 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium; h, hypopharynx; x, lateral process. x180
7 Respiratory organ of pupa. x100
8 Caudal appendage of pupa. x40

Diamesa waltlii

9 Ventral aspect of the head: md, mandible; mx, maxilla; p, palpus; ulr, labrum: la, lateral arms; l, labium; hy, hypopharynx

Chironomus sens. lat. sp.

10 Dorsal aspect of head: ds, dorsal sclerite; a, antenna (wanting); b, frontal process

PLATE 21

Chironomus tenellus

1 Ventral aspect of head of larva: ulr, labrum; la, lateral arms; md, mandible; mx, maxilla; p, palpus; l, labium. x150
2 Caudal end of pupa. x60
3 Lateral aspect of the fifth abdominal segment of pupa. x60
4 Antenna of larva. x150

Chironomus nigricans

5 Antenna of larva. x150
6 Ventral aspect of head of larva: l, labium; hy, hypopharynx; mx, maxilla; inx, inner lobe of maxilla; p, palpus. x150
7 Mandible of larva. x150
8 Anterior prolegs of larva. x25
9 Posterior end of larva. x25
10 Epipharynx of larva: an, anterior comb; c, posterior comb. x250
11 Dorsal aspect of second and third abdominal segments of pupa. x25
12 Comb at caudal end of lateral fin of eighth segment of pupa. x60

Chironomus flavicingula

13 Ventral aspect of epipharynx of larva, distended: f, posterior comb; s, curved setae. x250
14 Ventral aspect of labrum: a, epipharynx (shown enlarged in fig.13). x150
15 Dorsal aspect of labrum. x250
16 Dorsal aspect of third segment of pupa. x25
17 Lateral fin of eighth segment of pupa. x60
18 Labium of larva. x150
19 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus; hy, hypopharynx

PLATE 22

Chironomus flavus

1 Ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; hy, hypopharynx; l, labium; f, fan-membrane. x150

2 Caudal end of larva: a, caudal setae; b, blood gills. x35

3 Lateral aspect of second and third abdominal segments of pupa. x35

4 Spur of lateral fin of eighth segment of pupa. x60

Tanytarsus deflectus

6 Respiratory organ of pupa. x100

Chironomus sp. (81)

7 Ventral aspect of mouth parts, labium and maxilla. x100

Chironomus modestus

8 Eighth segment and anal appendage of pupa. x50

9 Antenna of larva. x100

10 Labrum, ventral aspect: la, lateral arms. x100

11 Ventral aspect: l. labrum; md, mandible; mx, maxilla; p, palpus; f, fan-like membrane. x100

12 Dorsal aspect of fourth abdominal segment of pupa. x50

Tanytarsus sp.

13 Dorsal aspect of fourth abdominal segment. x40

Chironomus modestus var. b.

14 Dorsal aspect of posterior part of abdomen of pupa. x40

Chironomus modestus var. a.

15 Dorsal aspect of fourth segment of abdomen of pupa. x50

16 Lateral fin of the eighth abdominal segment of pupa. x50

Tanytarsus sp.

17 Lateral fin of the eighth abdominal segment of pupa. x40

18 Spur of the lateral fin; possibly of another species. x100

Chironomus fulviventris

19 Posterior comb of the epipharynx of the larva. x100

Chironomus (?) fulvus

20 Dorsal aspect of abdominal segment of pupa. x50

Chironomus sp. (84)

21 Labium of larva. x100

Chironomus sp. (82)

22 Labium of larva. x180

Chironomus (?) fulvus

23 Lateral fin of the eighth segment of pupa. x50

Chironomus fulviventris

24 Labium of larva. x100

25 Antenna of larva. x100

26 Lateral fin of the eighth abdominal segment of pupa. x100

PLATE 23

Chironomus dorsalis

1 Labium of larva (after Miall and Hammond, 1900). x100

Chironomus lobiferus

2 Antenna of larva. x100
3 Ventral aspect of larval head: l, labium; mx, maxilla; p, palpus; f, fan-like membrane. x100
4 Lobe of an abdominal segment of the imago. x100
5 Comb of the lateral fin of the eighth segment of the pupa. x400

Chironomus sp. (83)

6 Labium of larva. x180

Chironomus decorus

7 Mandible of larva. x150
8 Labium of larva. x100
9 Pupa. x6
10 Ventral aspect of labrum of larva: an, anterior comb; c, posterior comb; lr, lateral arm. x150
11 Dorsal aspect of second abdominal segment of pupa. x40
12 Anal end of pupa. x40
13 Labium of larva (of another variety or possibly species). x180

Chironomus (?) plumosus

14 Spur of the lateral fin of eighth segment of pupa. x100
15 Labium of larva. x180
16 Maxilla of larva: p, palpus. x180

PLATE 24

Cricotopus exilis

1 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus; hy, hypopharynx. x250
2 Ventral aspect of the labrum. x250
3 Caudal end of pupa. x60
4 Mandible of larva. x250

Cricotopus trifasciatus

5 Ventral aspect of mouth parts of larva, labium and maxilla. x150
6 Mandible of larva. x150
7 Lateral aspect of abdominal segments of pupa. x35
8 Respiratory organ of pupa. x150
9 Lateral hair-tuft of larva. x150
10 Caudal end of pupa with the caudal end of enclosed imago. x35

Orthocladius flavus

11 Hypopharynx of larva. x80
12 Ventral aspect of mouth parts of larva: a, antenna; md, mandible; mx, maxilla; p, palpus; l, labium. x80
13 Respiratory organ of pupa. x60
14 Ventral aspect of labrum of larva: la, lateral arm. x250
15 Lateral aspect of the posterior end of the seventh abdominal segment of the pupa
16 Caudal end of pupa. x25
17 Larval case, natural size

Orthocladius nivoriundus

18 Ventral aspect of labrum of larva: la, lateral arm. x150
19 Antenna of larva. x150
20 Mandible of larva. x150
21 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; hy, hypopharynx. x150
22 Dorsal aspect of abdominal segment of pupa. x80
23 Respiratory organ of pupa. x60
24 Caudal appendage of pupa. x35

PLATE 25

Orthocladius fugax

1 Mandible of larva. x150
2 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus; hy, hypopharynx
3 Latero-ventral aspect of labrum of larva: a, antenna; ep, epipharynx; c, lateral arm. x150
4 Respiratory organ of pupa. x150
5 A pectinate hair from anterior prolegs of larva. x400
6 Caudal end of larva. x60
7 Lateral aspect of second, third and fourth abdominal segments of pupa. x60
8 Claw of posterior proleg of larva. x250
9 Peripheral claw of posterior proleg of larva. x250
11 Dorsal aspect of fifth abdominal segment of pupa

Orthocladius sordidellus

12 Ventral aspect of labrum of larva. x180
13 Antenna of larva. x180
14 Ventral aspect of mouth parts of larva: l, labium; md, mandible; mx, maxilla; p, palpus; lr, labrum. x250
15 Lateral aspect of abdominal segment of pupa. x150

Tanytarsus dissimilis

16 Ventral aspect of mouth parts of larva: l, labium; md, mandible; mx, maxilla; p, palpus; lr, labrum. x250
17 Antenna of larva. x250
18 Dorsal aspect of abdomen of pupa of variety a. x60
19 Comb of the lateral fin of the eighth segment of pupa. x250
20 Dorsal aspect of the abdomen of pupa. x60
21 Comb of lateral fin of eighth segment of pupa. x250

Cricotopus varipes

22 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus

PLATE 26

Tanytarsus dives

1 Dorsal aspect of head of larva: a, antenna; lr, labrum. x60
2 Apical end of mandible of larva. x150
3 Respiratory organ of pupa. x60
4 Ventral aspect of mouth parts of larva: l, labium; mx, maxilla; p, palpus; imx, inner lobe of maxilla; hy, hypopharynx. x250

5 Caudal end of larva. x25
6 Caudal end of pupa. x25
7 Dorsal aspect of abdominal segments of pupa. x25

Tanytarsus exiguus

8 Larva. x20
9 Fibrous case of larva and pupa. x6
11 Dorsal aspect of second abdominal segment of pupa. x100
12 Ventral aspect of mouth parts of larva: l, labium; md, mandible; mx, maxilla; p, palpus. x400
13 Antenna of larva. x250
14 Latero-ventral aspect of head of larva: a, antenna; md, mandible; mx, maxilla; l, labium
15 Caudal end of pupa (male). x100

PLATE 27

1 Procladius pusillus
2 Procladius caliginosus
3 Procladius pinguis
4 Procladius scapularis
5 Ablabesmyia carnea var. c.
6 Ablabesmyia monilis
7 Tanypus stellatus
8 Ablabesmyia venusta
9 Ablabesmyia dyari
10 Ablabesmyia melanops
11 Ablabesmyia flavifrons
12 Ablabesmyia indecisa
13 Ablabesmyia indecisa (after Williston)
14 Ablabesmyia pallens, var. a.
15 Tanypus culiciformis
16 Chasmatonotus bimaculatus

PLATE 28

1 Chironomus brachialis
2 Chironomus scalaenus
3 Chironomus spilopterus (after Williston)
4 Chironomus taeniapennis
5 Chironomus caliginosus
6 Chironomus flavicingula
7 Chironomus halteralis
8 Chironomus fallax
9 Chironomus riparius
10 Chironomus barbipes
11 Chironomus annularis
12 Chironomus albimanus (male)
13 Chironomus albimanus (female)
14 Chironomus devinctus
15 Chironomus nigricans
16 Chironomus pedellus
17 Chironomus aberrans

18 Chironomus fumidus
19 Chironomus fulvus
20 Chironomus flavus

PLATE 29

1 Chironomus modestus var. a. female
2 Chironomus modestus var. a. female
3 Chironomus modestus var. b. male
4 Chironomus modestus female
5 Chironomus pallidus
6 Chironomus fulviventris
7 Chironomus frequens
8 Chironomus dux
9 Chironomus viridicollis
10 Chironomus longimanus (after Williston)
11 Chironomus plumosus
12 Chironomus decorus
13 Chironomus similis
14 Chironomus cristatus
15 Cricotopus trifasciatus
16 Cricotopus exilis
17 Cricotopus bicinctus
18 Cricotopus varipes
19 Cricotopus sylvestris
20 Cricotopus debilis (after Williston)

PLATE 30

1 Camptocladius sp.
2 Camptocladius fumosus
3 Camptocladius byssinus
4 Camptocladius minimus
5 Orthocladius sordens
6 Orthocladius flavus
7 Orthocladius sordidellus
8 Orthocladius nivoriundus
9 Orthocladius absurdus
10 Orthocladius fugax
11 Orthocladius obumbratus
12 Thalassomyia fusca
13 Diamesa waltlii
14 Tanytarsus obediens
15 Tanytarsus gmundensis
16 Tanytarsus deflectus
17 Tanytarsus dives
18 Tanytarsus fatigans
19 Tanytarsus fulvescens
20 Tanytarsus muticus
21 Tanytarsus flavellus

PLATE 31

1 Metriocnemus flavifrons
2 Metriocnemus par
3 Metriocnemus lundbeckii
4 Metriocnemus exagitans
5 Metriocnemus atratulus
6 Chasmatonotus bimaculatus (head of male)
7 Diamesa waltlii (antenna of female)
8 Orthocladius absurdus (antenna of female)
9 A part of an egg string of Sphaeromyas argentatus
10 An egg mass of Chironomus sp. x2
11 An egg mass of Tanypus sp. (after Miall)
12 A part of an egg string of Chironomus sp.
13-14 A part of the egg string of Chironomus dorsalis (after Miall and Hammond)
15 A part of an egg string of Chironomus sp.
16 Dorsal aspect of thorax of a male Chasmatonotus bimaculatus. x40

PLATE 32

Genitalia: d, dorsal keel; l, lateral; s, superior; i, inferior lobe
1 Bezzia setulosa. Dorsal aspect. Male. x100
2 Tanypus culiciformis. Male. x100
3 Ablabesmyia monilis. Male. x100
4 Corynoneura celeripes (after Kieffer)
5 Diamesa praecox (after Kieffer)
6 Chasmatonotus bimaculatus. Dorsal aspect. Male. x50
7 Chironomus flavicingula. Dorsal aspect. Male. x100
8 Chironomus modestus. Dorsal aspect. Male. x100
9 Chironomus modestus var. b. Latero-ventral aspect. Male. x100
10 Chironomus fulviventris. Male. x100
11 Chironomus modestus. Female. x100
12 Chironomus flavus. Ventral aspect. Male. x100
13 Chironomus decorus. Dorsal aspect. Male. x100
14 Diamesa waltlii. Dorsal aspect. Male. x50

PLATE 33

Genitalia: d, dorsal keel; l, lateral lobe; s, superior lobe; i, inferior lobe; a, appendage of the superior lobe
1 Orthocladius kervilli (after Kieffer)
2 Cricotopus exilis. Male. x100
3 Tanytarsus dissimilis. Ventral aspect. Male. x150
4 Tanytarsus exiguus. Ventral aspect. Male. x350
4a Tanytarsus exiguus. Male. Latero-ventral aspect. x100
5 Tanytarsus dives. Male. Dorsal aspect. x100
6 Metriocnemus par. Male. Lateral aspect. x100
7 Orthocladius absurdus. Lateral aspect. Female. x100
8 Metriocnemus atratulus (after Kieffer)

PLATE 34

Compontia cruciformis (=Thalassomyia frauenfeldii?)

1 Dorsal aspect of larva (after Theobald, 1892)

Hydrobaenus lugubris (after Fries)

2 Dorsal aspect of head of larva
3 Anterior prolegs of larva
4 Lateral aspect of larva
5 Lateral aspect of pupa
6 Antenna of female
7 Antenna of male
8 Caudal appendage of pupa
9 Wing of imago
10 Male genitalia
11 Lateral aspect of male clasper

Telmatogeton St Pauli (after Schiner)

12 Lateral aspect of larva.
13 Anterior prolegs of larva
14 Lateral aspect of pupa
15 Caudal sucker of pupa
16 Wing of imago

Orthocladius ? oceanicus (after Packard)

17 Ventral aspect of larval head
18 Posterior prolegs of larva
19 Anterior proleg of larva

Wulpiella scirpi (after Kieffer)

20 Wing of imago
21 Dorsal aspect of larva
22 Anterior proleg of larva
23 Ventral aspect of head of larva

Eurycnemus sp.

24 Lateral aspect of male (after Van der Wulp.)

PLATE 35

Macropeza

1 Anterior part of wing of imago (after V. d. Wulp)
2 Wing of imago (after Meigen)
3 Antenna of imago (after Meigen)

Psamathiomyia pectinata (after Deby)

4 Wing of male
5 Wing of female
6 Antenna
7 Haltere of male
8 Leg of male
9 Dorsal aspect of head and thorax

Tersesthes torrens (after Townsend)

10 Wing of imago
12 Palp of imago
13 Antenna of imago

Leptoconops (after Skuse)

14 Wing of adult

Eretmoptera (after Kellogg)

15 Foot of imago
16 Palp of imago
17 Labium of imago
18 Hypopharynx of imago
19 Labium-epipharynx of imago
20 Haltere of imago
21 Dorsal aspect of the male
22 Antenna of male
23 Antenna of female
24 Male genitalia

Didymorphleps (after Weyenbergh)

25 Wing of imago

Burmeisteria (after Weyenbergh)

26 Wing of imago
27 Lateral aspect of head and thorax of male
28 Haltere

Stenoxenus (after Coquillett)

29 Wing of female

PLATE 36

Corynoneura lemnae (after Frauenfeld)

1 Lateral aspect of larva
2 Anterior prolegs of larva
3 Posterior prolegs of larva
4 Caudal end of pupa
5 Lateral aspect of pupa

Corynoneura sp. (after Winnertz)

6 Hind leg of imago
7 Wing of imago
8 Palpus of imago
9 Antenna of male
10 Antenna of female

Clunio marinus

11 Lateral aspect of larva (after Carpenter)
12 Dorsal aspect of male (after Theobald)
13 Dorsal aspect of female (after Carpenter)

Diamesa culicoides (after Heeger except fig.14)

14 Lateral aspect of larva (after Brauer)
15 Dorsal aspect of larva
16 Ventral aspect of pupa
17 Lateral aspect of pupa
18 Mandible of larva
19 Labium of larva
20 Maxilla of larva
21 Labrum of larva
22 Antenna of larva
23 "Underlip" (i. e. hypopharynx) of larva
24 Claw of hind foot of larva
25 Anterior proleg of larva

Doloplastus (after Skuse)

26 Wing of imago

PLATE 37

Limnophyes (after Verrall)

1 Dorsal aspect of female
2 Mouth parts of female
3 Antenna
4 Lateral aspect of head and thorax

Halirytus (after Verrall)

5 Fore leg of female
6 Lateral aspect of female
7 Antenna of female

Heteromyia (after Say)

8 Wing of imago
9 Fore leg of imago

Podonomus (after Philippi)

10 Antenna
11 Wing of imago

Procladius (after Skuse)

12 Wing of imago

Spaniotoma (after Philippi)

13 Wing of adult
14 Antenna

Isoplastus (after Skuse)

15 Wing of imago

Pentaneura (after Philippi)

16 Wing of imago

Ablabesmyia pulchripennis (after Lundbeck)

17 Wing of imago

Tetraphora (after Philippi)

18 Wing of imago
19 Antenna of imago

Tanypus posticalis (after Lundbeck)

20 Wing of imago

Heptagyia (after Philippi)

21 Wing of imago
22 Antenna of imago
23 Palpus of imago

Procladius nervosus (after V. d. Wulp)

24 Wing of imago

Chironomus prasinus

25 Labium of larva (after Hammond)

Chironomus sp.

26 Labium of larva (after Osborn)

Chironomus tentans (after Weyenbergh)

27 Labium of larva
28 Apex of mandible of larva

LEGENDA TO TEXT FIGURES

Fig. 1 Venation of the wings of Siphlurus; lettering explained in text. p.20

Fig. 2 Wings of Callibaetis. p.21

Fig. 3 Venation of the fore wing of Ephemera. p.22

Fig. 4 The nymphal labium of Baetisca obesa Say. (The two muscle bands indicated by dotted lines in the basal segment of the left palpus are the same that move the lateral lobe of the dragonfly labium). p.30

Fig. 5 Ameletus ludens sp. nov., female subimago; u, end of abdomen from below, showing truncate apical lobe of the 9th sternum; v, fore tibia and tarsus. p.36

Fig. 6 Parts of nymph of Ameletus ludens sp. nov.; y, maxilla; z, single gill lamella from one of the middle abdominal segments. p.37

Fig. 7 Gill lamellae of the nymph of Blasturus cupidus Say; e, from the 1st segment; f, from the 4th segment; g, from the 7th segment. p.41

Fig. 8 Venation of wing of ?Caenis allecta sp. nov. p.48

Fig. 9 Ventral view of male abdominal appendages of ? Caenis allecta sp. nov., imago. p.48

Fig. 10 Ventral view of male abdominal appendages of Ecdyurus maculipennis Walsh, imago; f, forceps; i, inner appendages. p.51

Fig. 11 Tarsal claws of nymphs of Heptageninae; w, of Heptagenia interpunctata Say; x, of Rhithrogena elegantula Etn.?; y, of Iron sp? from Coy Glen, Ithaca; z, of Ecdyurus maculipennis Walsh; hind claws in each case; middle ones would be similar; front ones sometimes different. p.52

Fig. 12 Labra of nymphs of Heptageninae; h, of Iron sp? from Coy Glen, Ithaca: i, of Rhithrogena elegantula Etn.?; j, of Ecdyurus maculipennis Walsh; k, of Heptagenia interpunctata Say. p.52

Fig. 13 Mandibles of nymphs of Heptageninae; c, of Rhithrogena elegantula Etn.?; d, of Iron sp? from Coy Glen. Ithaca; e, of Ecdyurus maculipennis Walsh; f, of Heptagenia interpunctata Say. p.52

Fig. 14 Maxillae of nymphs of Heptageninae; m, of Iron sp? from Coy Glen, Ithaca; n, of Heptagenia interpunctata Say; o, of Rhithrogena elegantula Etn.?: p, of Ecdyurus maculipennis Walsh. p.53

Fig. 15 Hydroptilid structures: Agraylea multipunctata; 40, apex of abdomen from beneath; 41, same from side; 42, triangular pieces from side; 43, same when much exserted; 44, ventral lamina; Orthotrichia americana (?); 45, apex of abdomen from beneath. p.73

Fig. 16 Ventral aspect of larval mouth parts of Metriocnemus knabi. x180. p.306

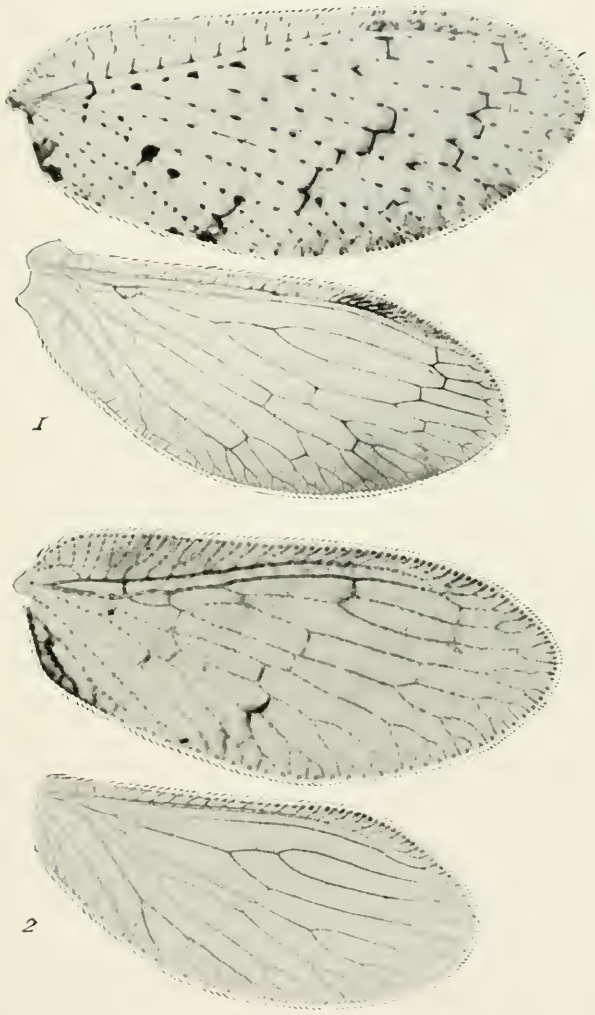
Fig. 17 Dorsal aspect of caudal end of pupa of Metriocnemus knabi. x180. p.306

Fig. 18 Mandible and labium; larva A, x400; larva B, x180. p.309

Plate 1

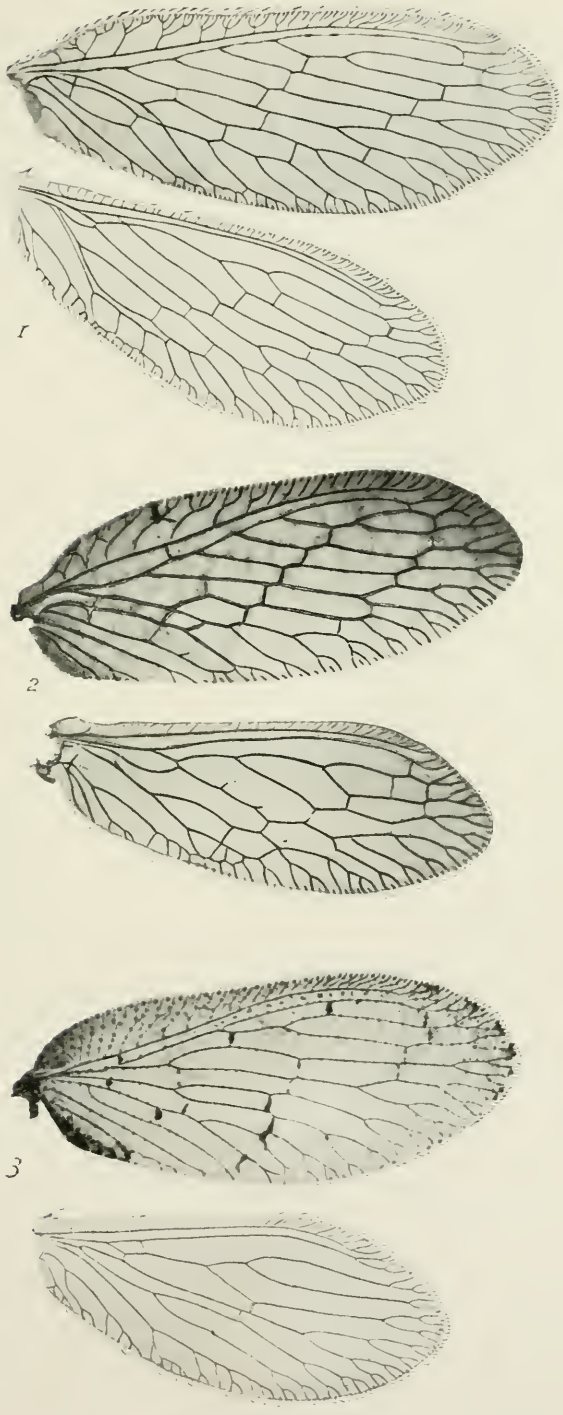
Bullfrog

Plate 2



Hemerobian wings

Plate 3

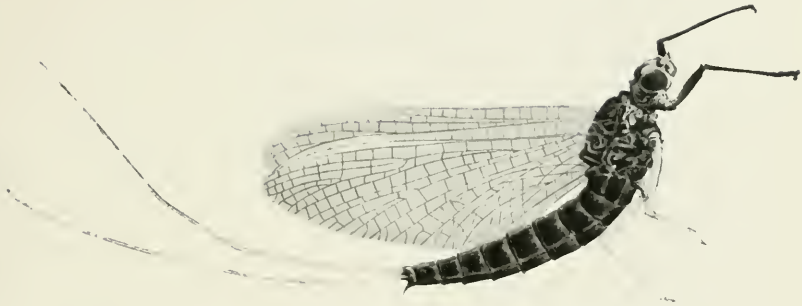


Hemerobian wings

Plate 4

May fly structures

Plate 5



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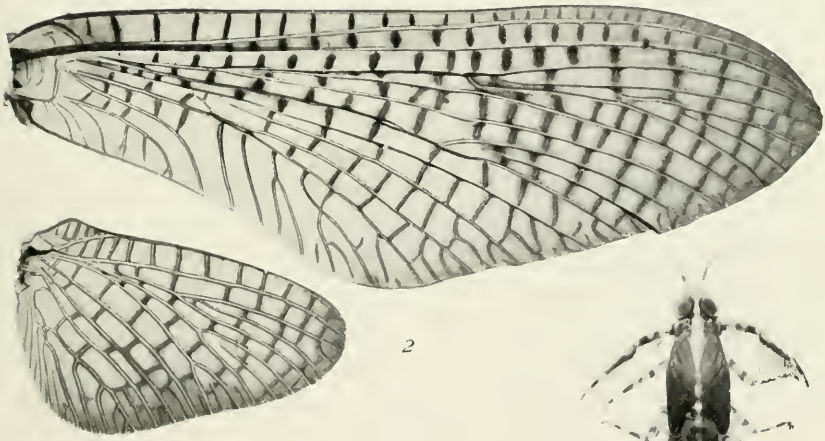

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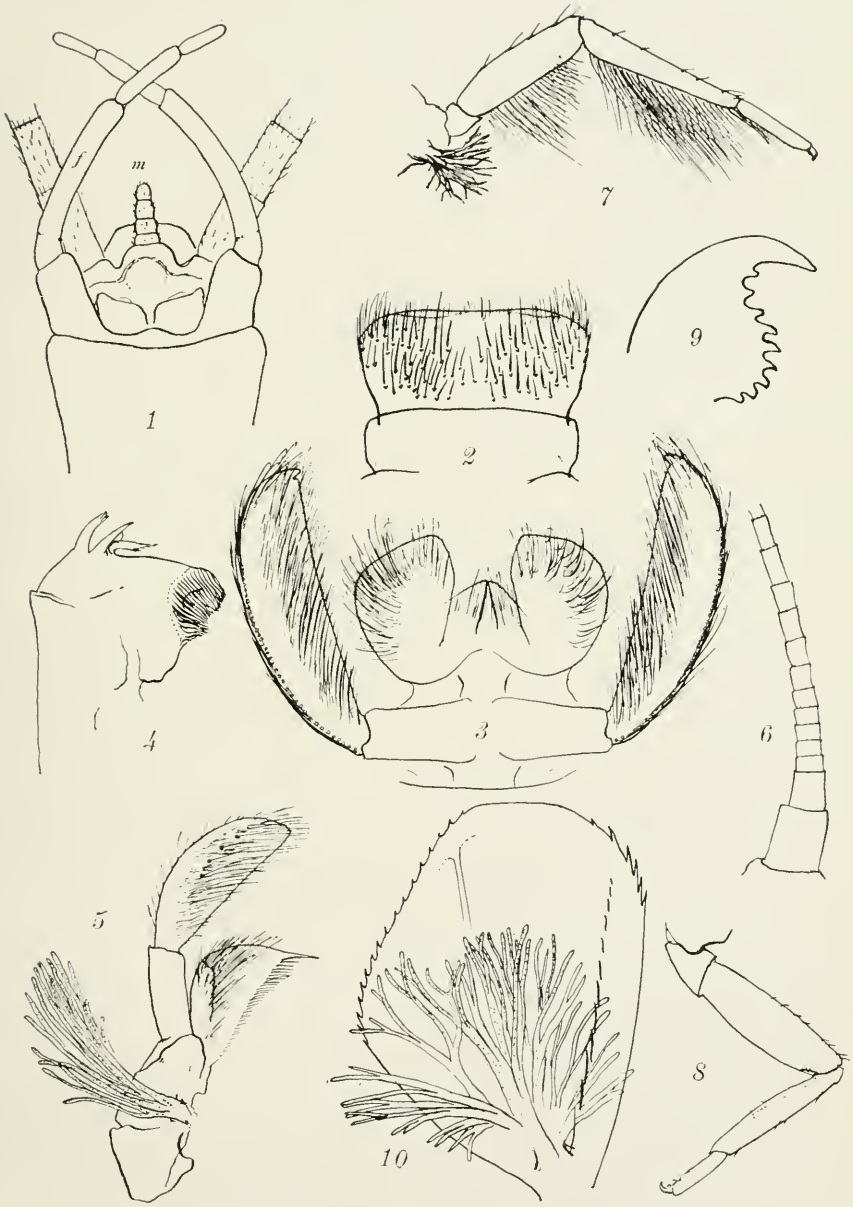
4

3

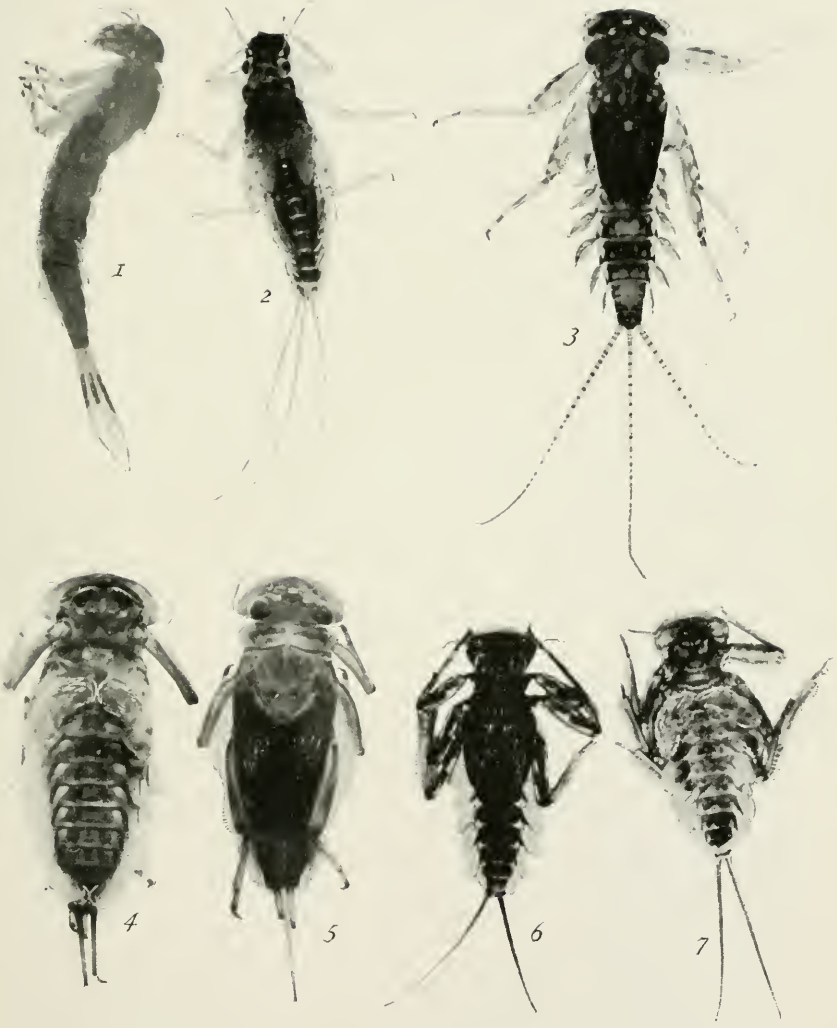
Chirotenetes
The white-gloved howdy

Plate 6



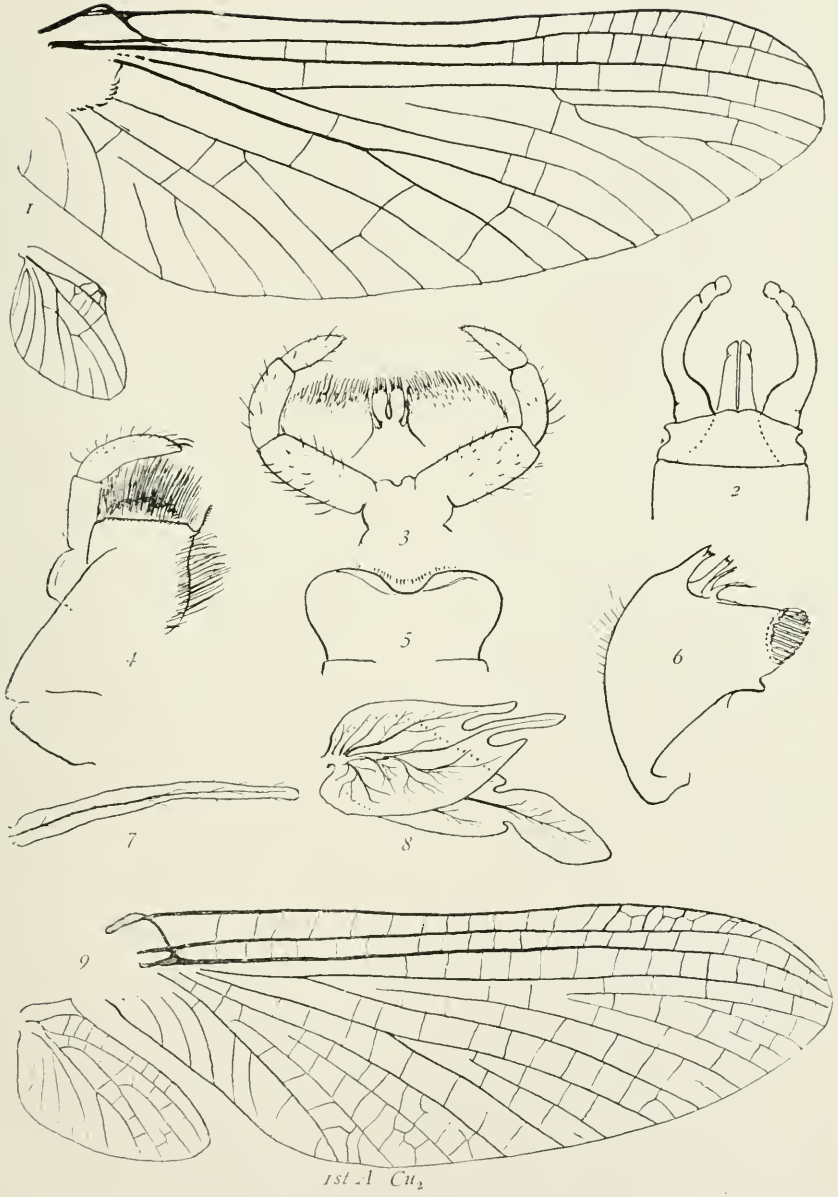
Chirotenetes

Plate 7



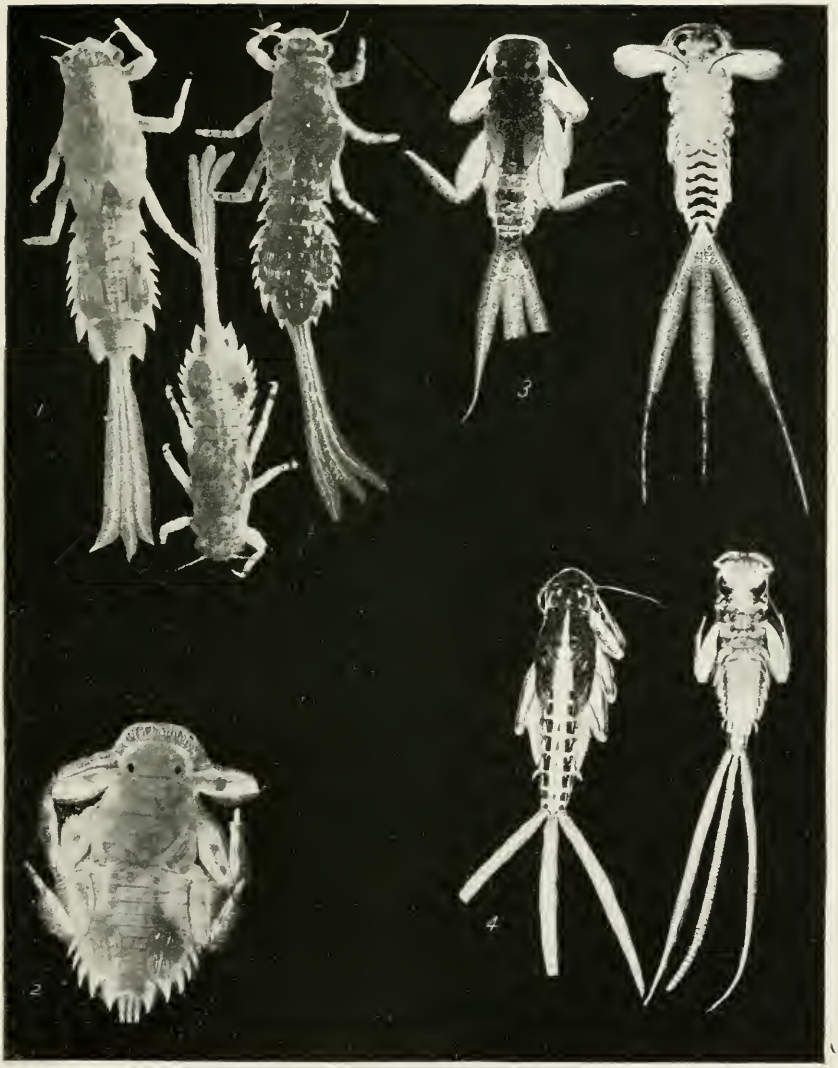
May fly nymphs

Plate 8



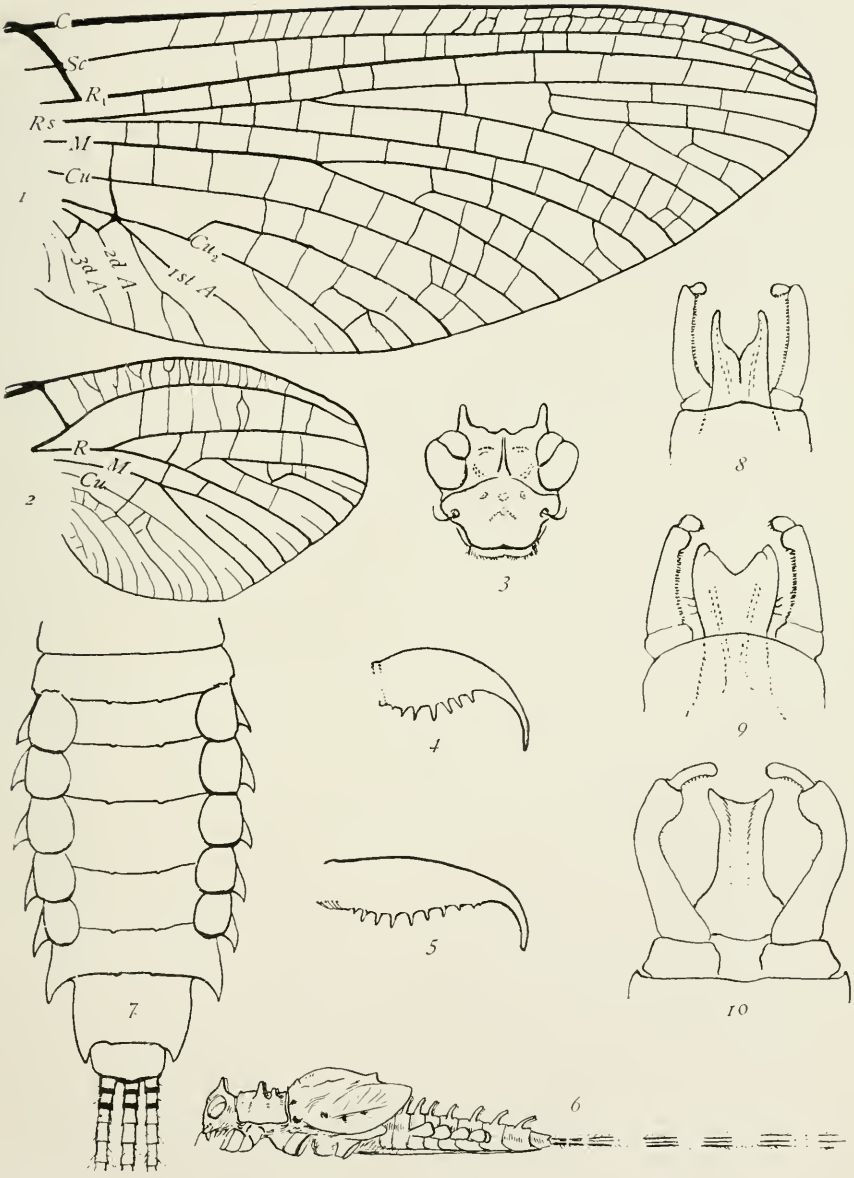
Choroterpes and Ameletus

Plate 9



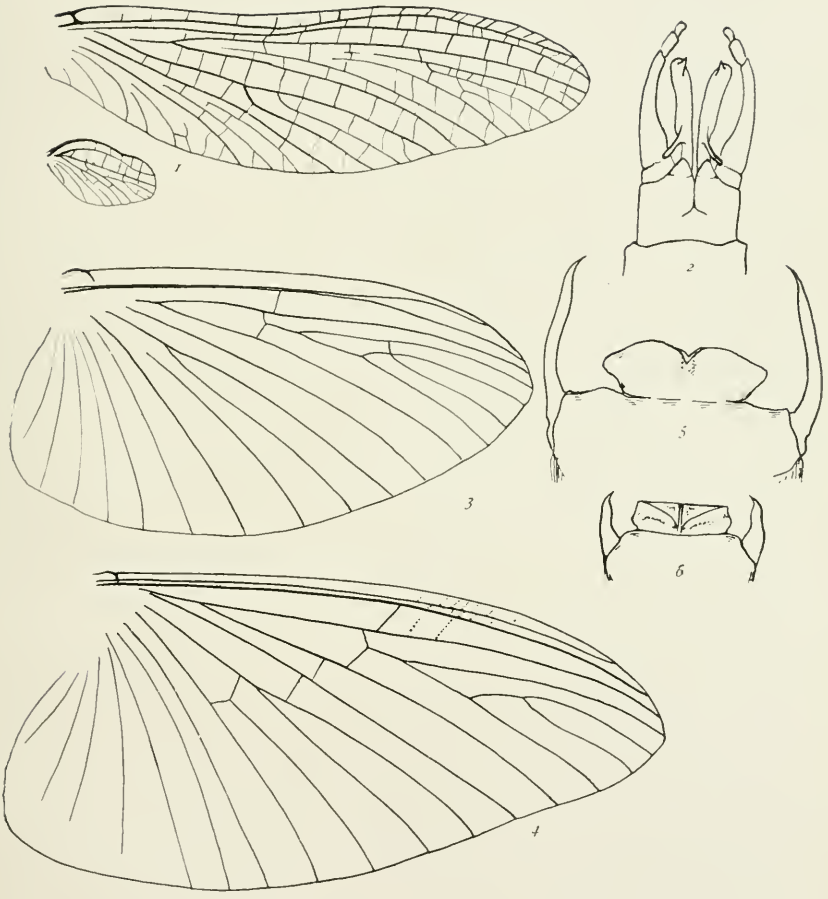
May fly nymphs

Plate 10



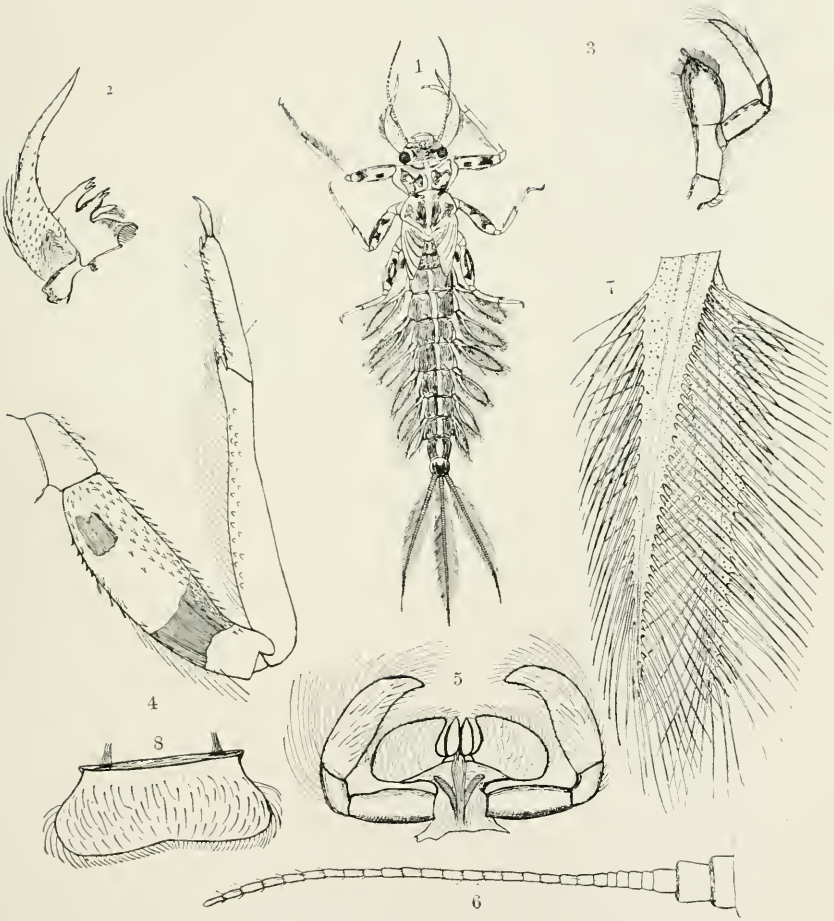
Drunella and Ephemerella

Plate 11



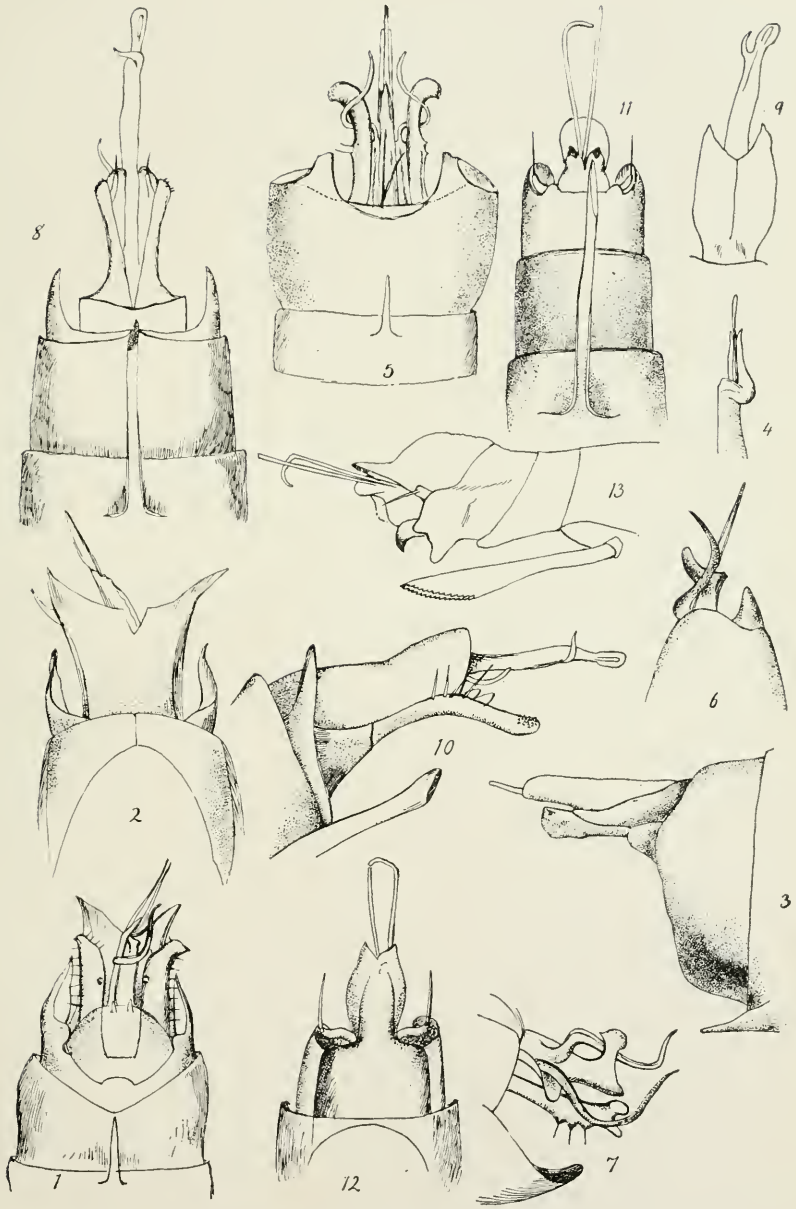
Leptophlebia and Caenis

Plate 12



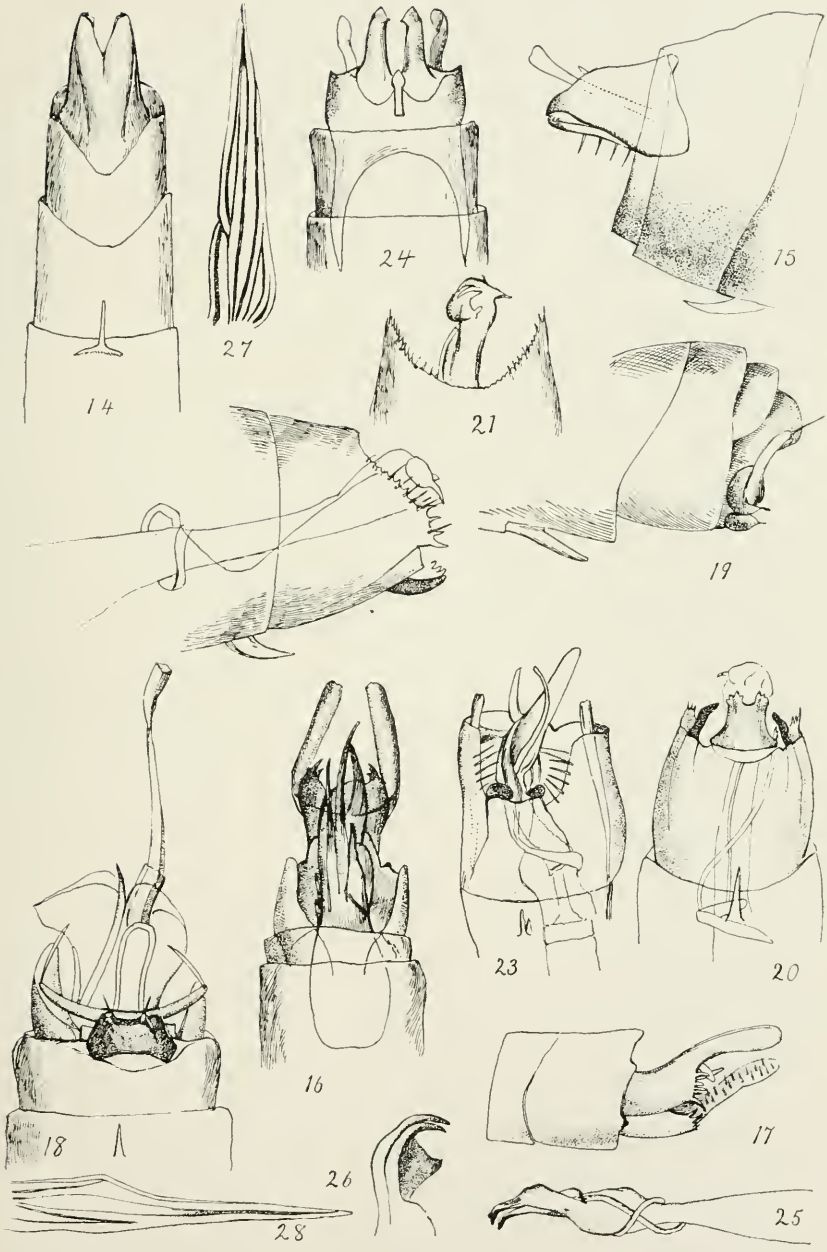
Polymitareys albus

Plate 13



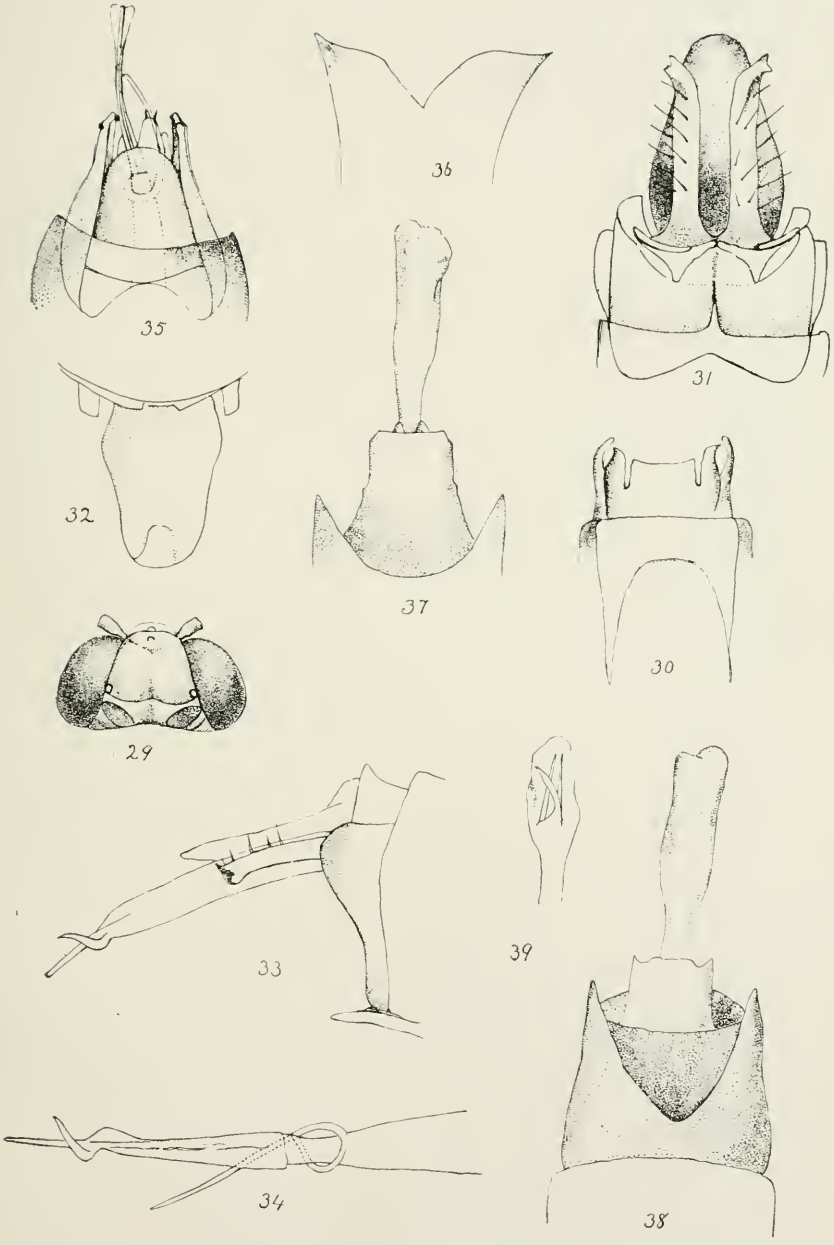
Hydroptilid structures

Plate 14



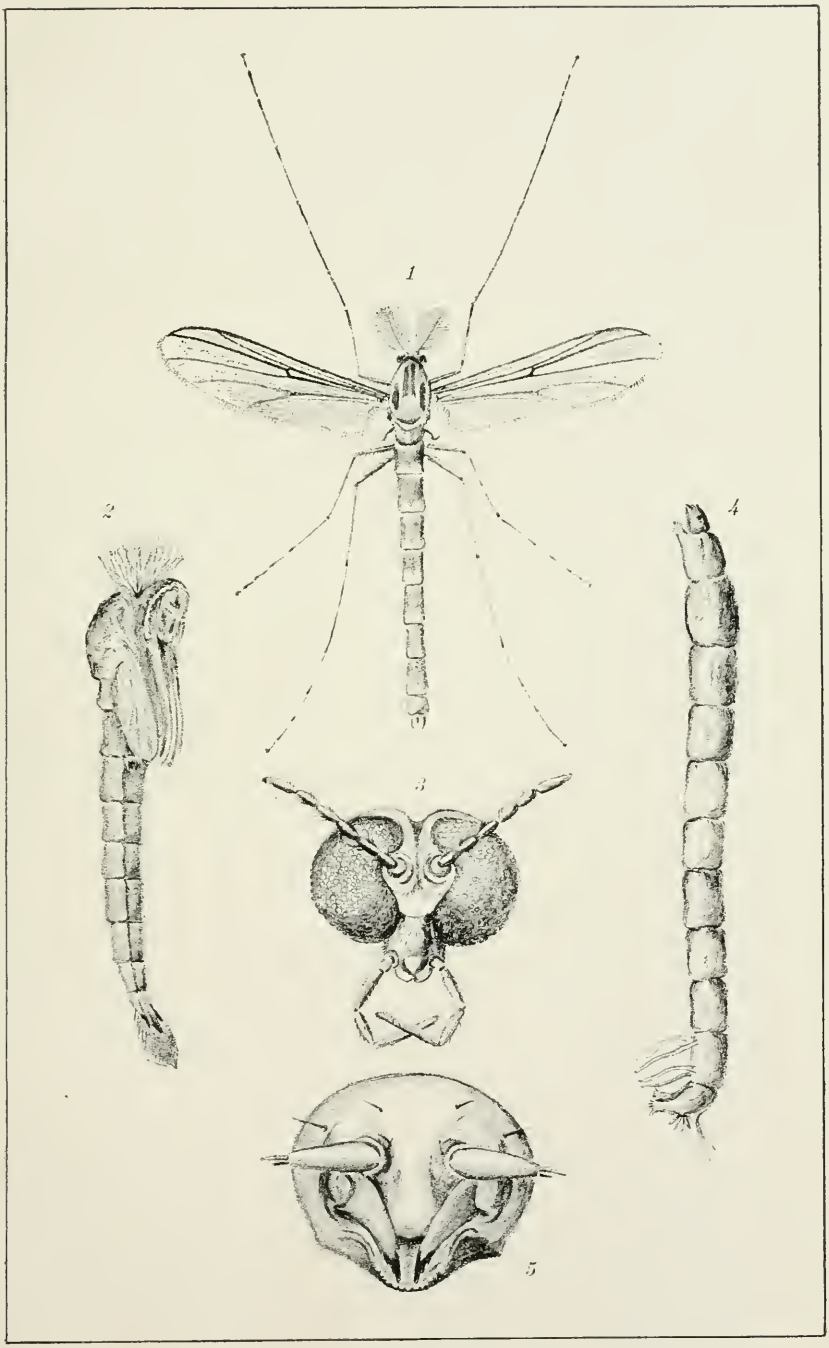
Hydroptilid structures

Plate 15



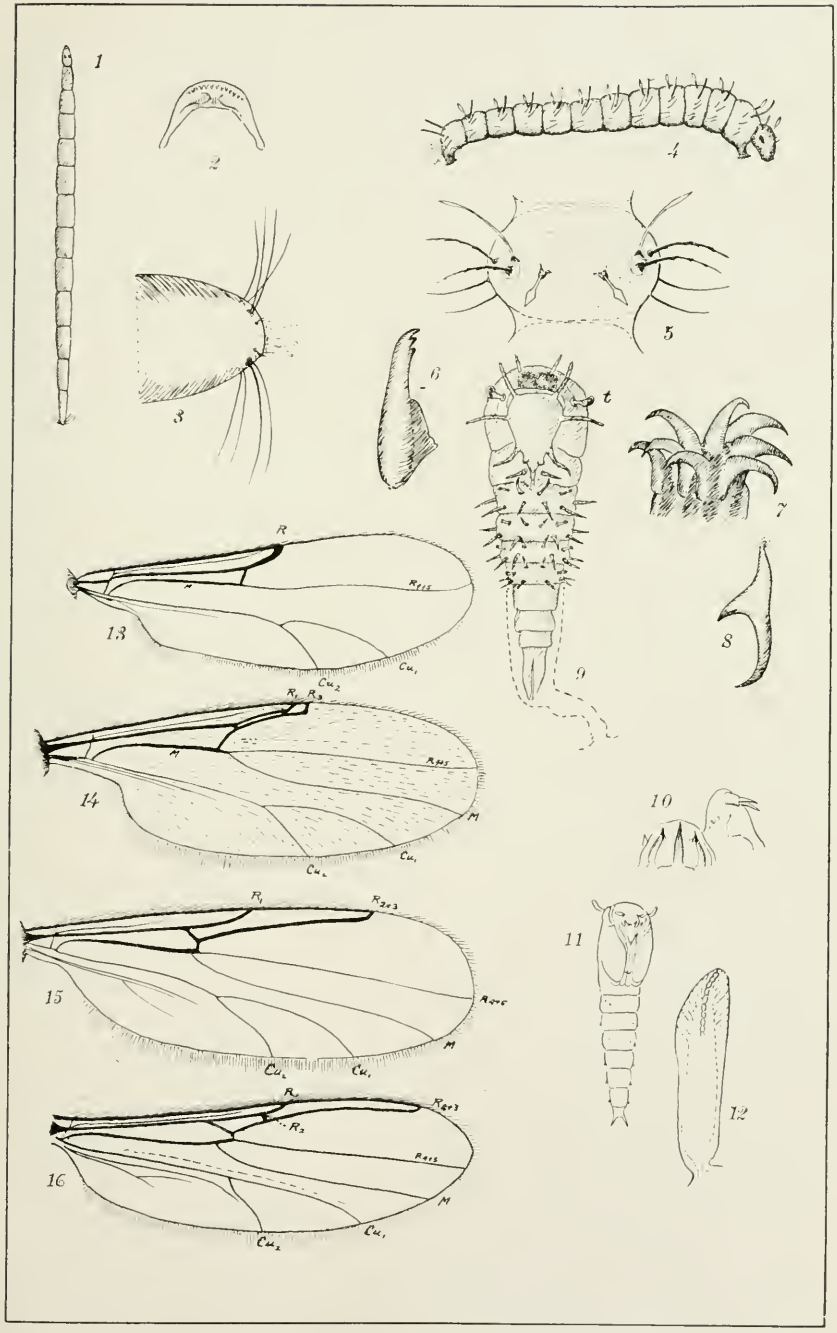
Hydroptilid structures

Plate 16

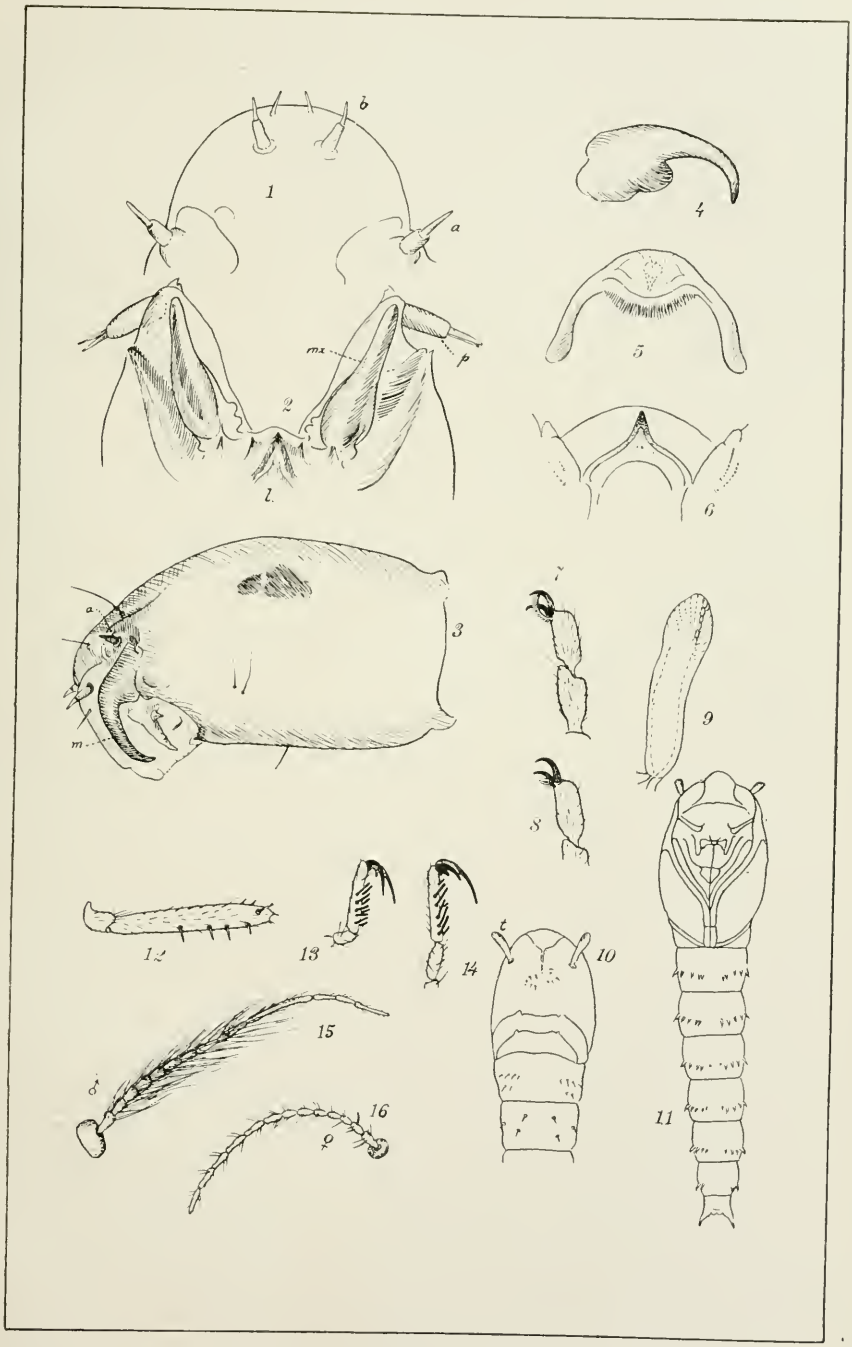


Chironomus

Plate 17

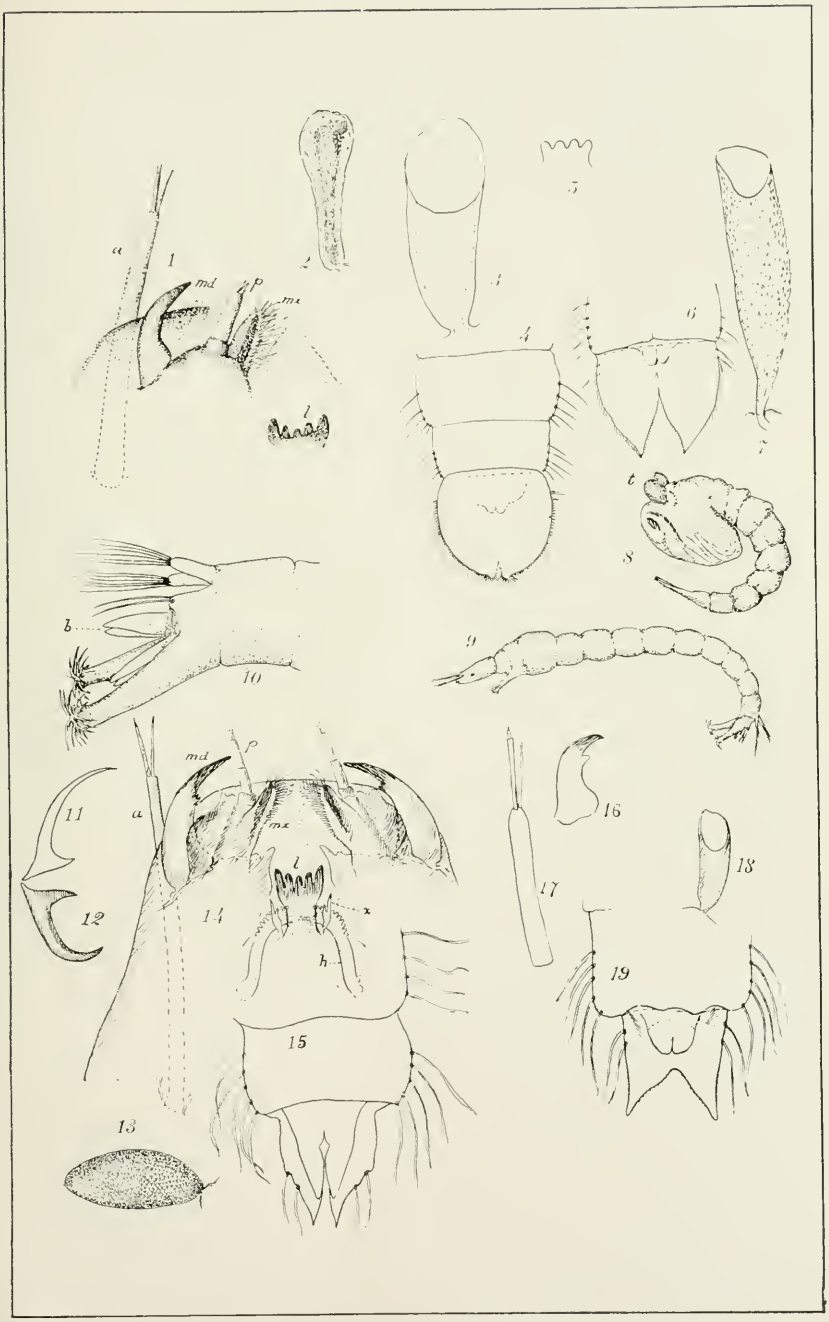


Ceratopogon group



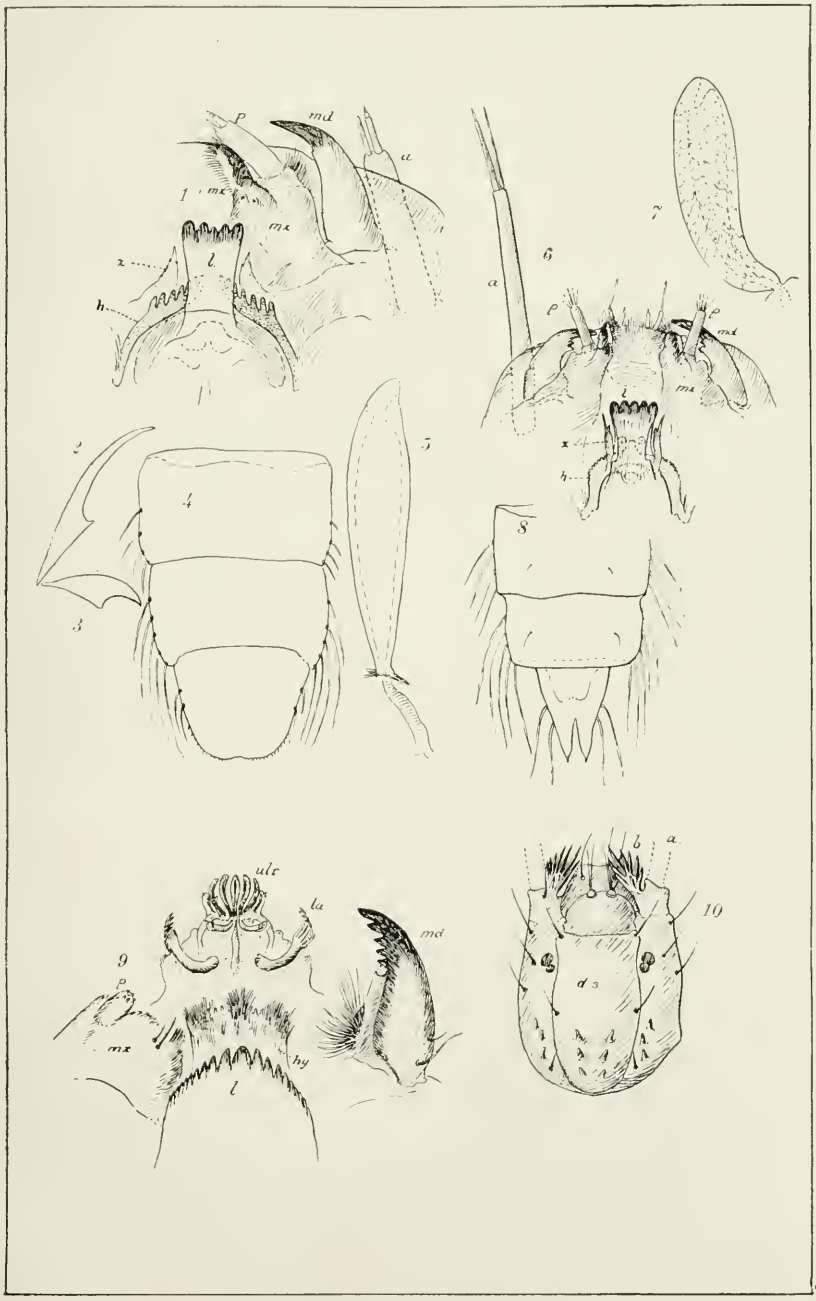
Ceratopogon group

Plate 19



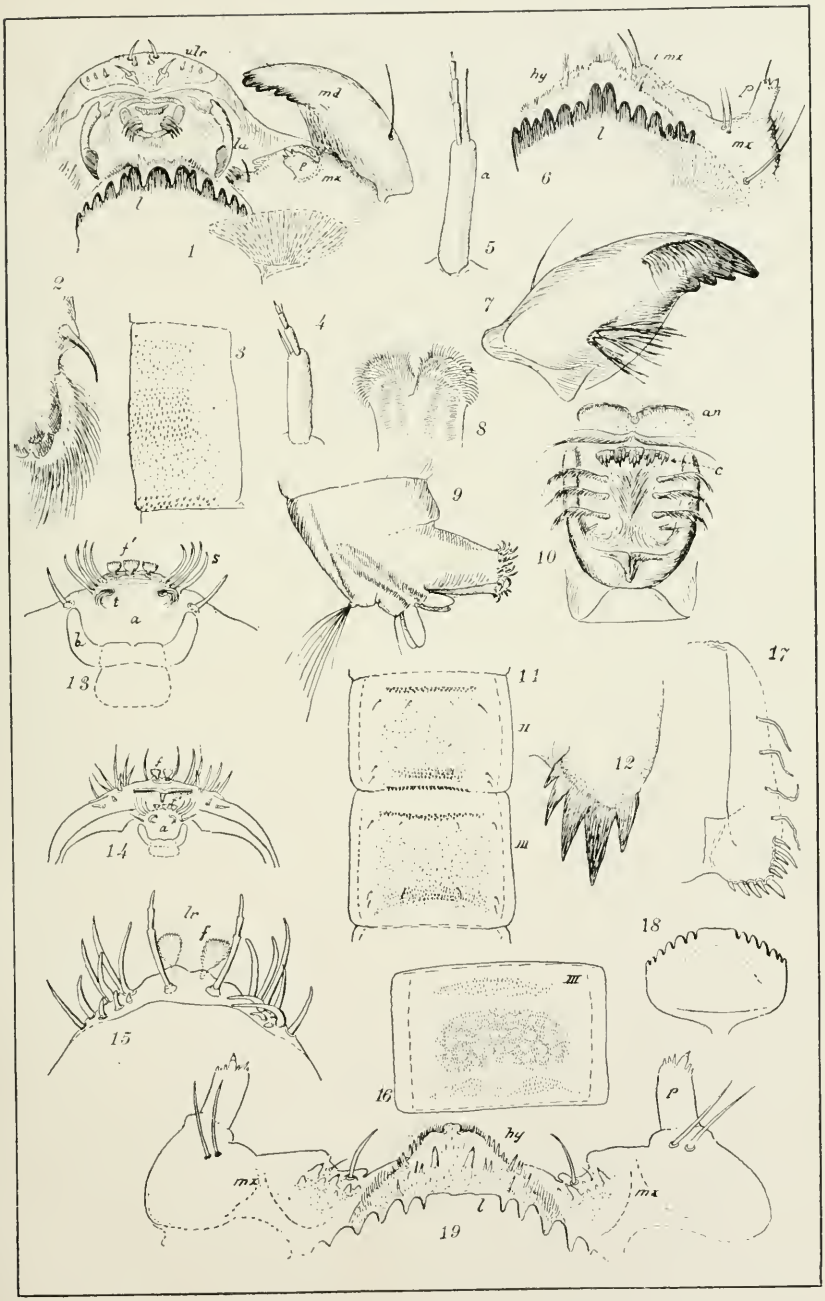
Tanypus group

Plate 20



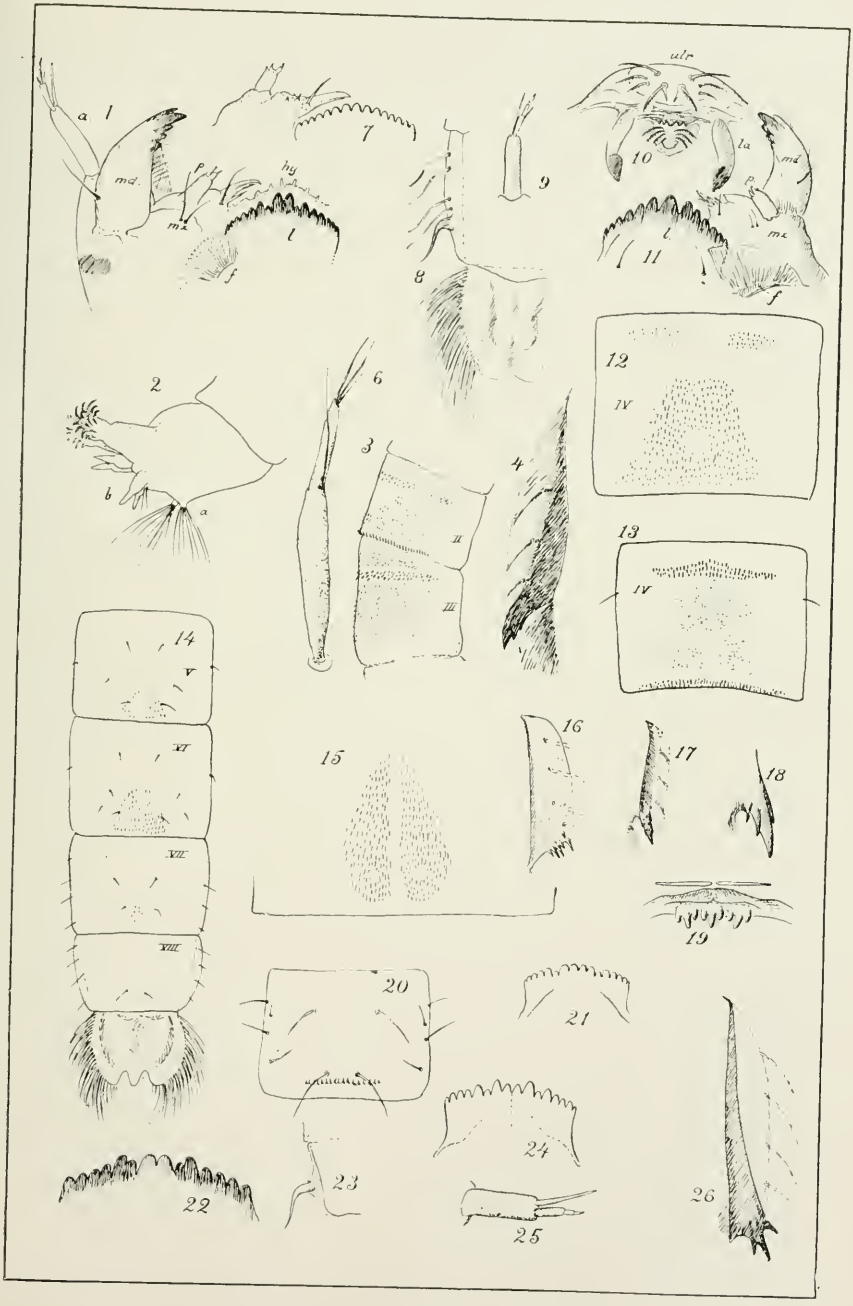
Tanypus group and others

Plate 21



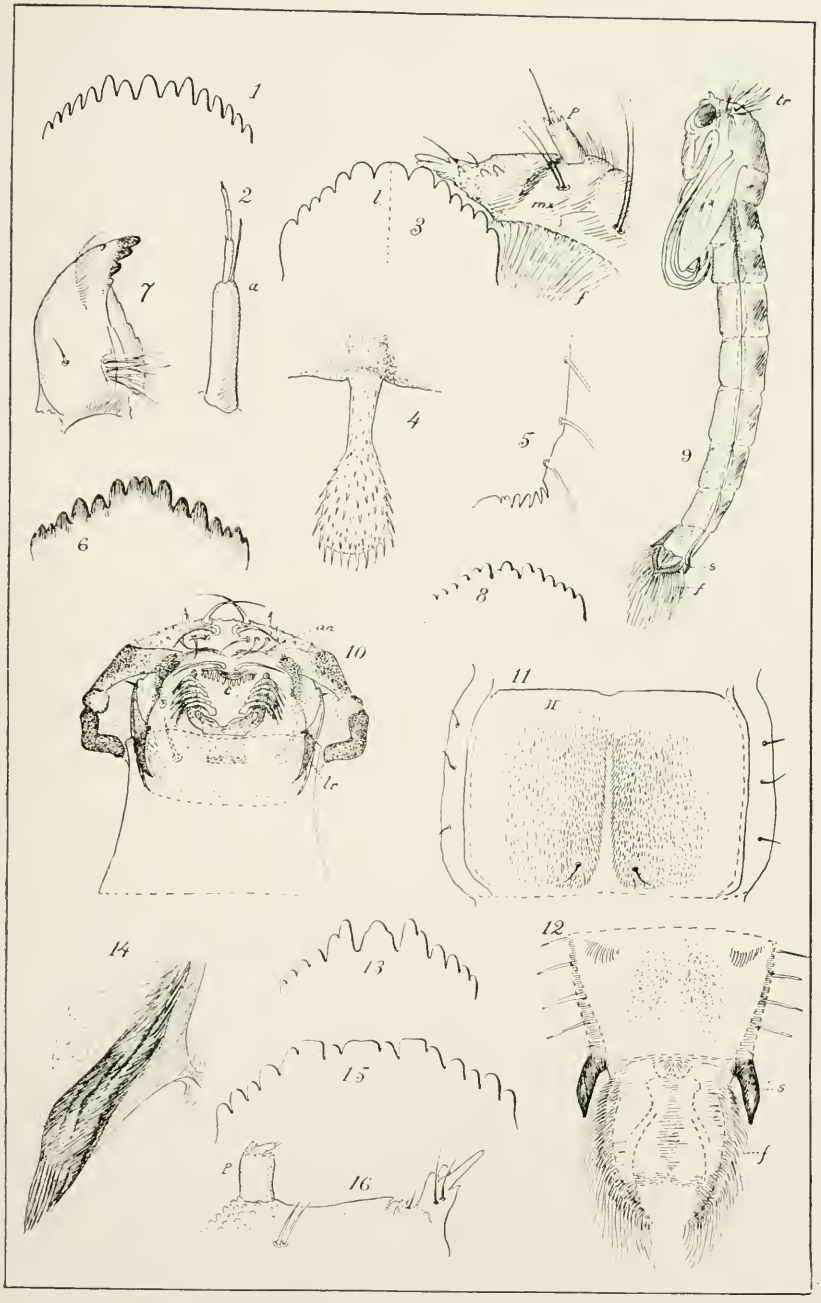
Chironomus: details of larva and pupa

Plate 22

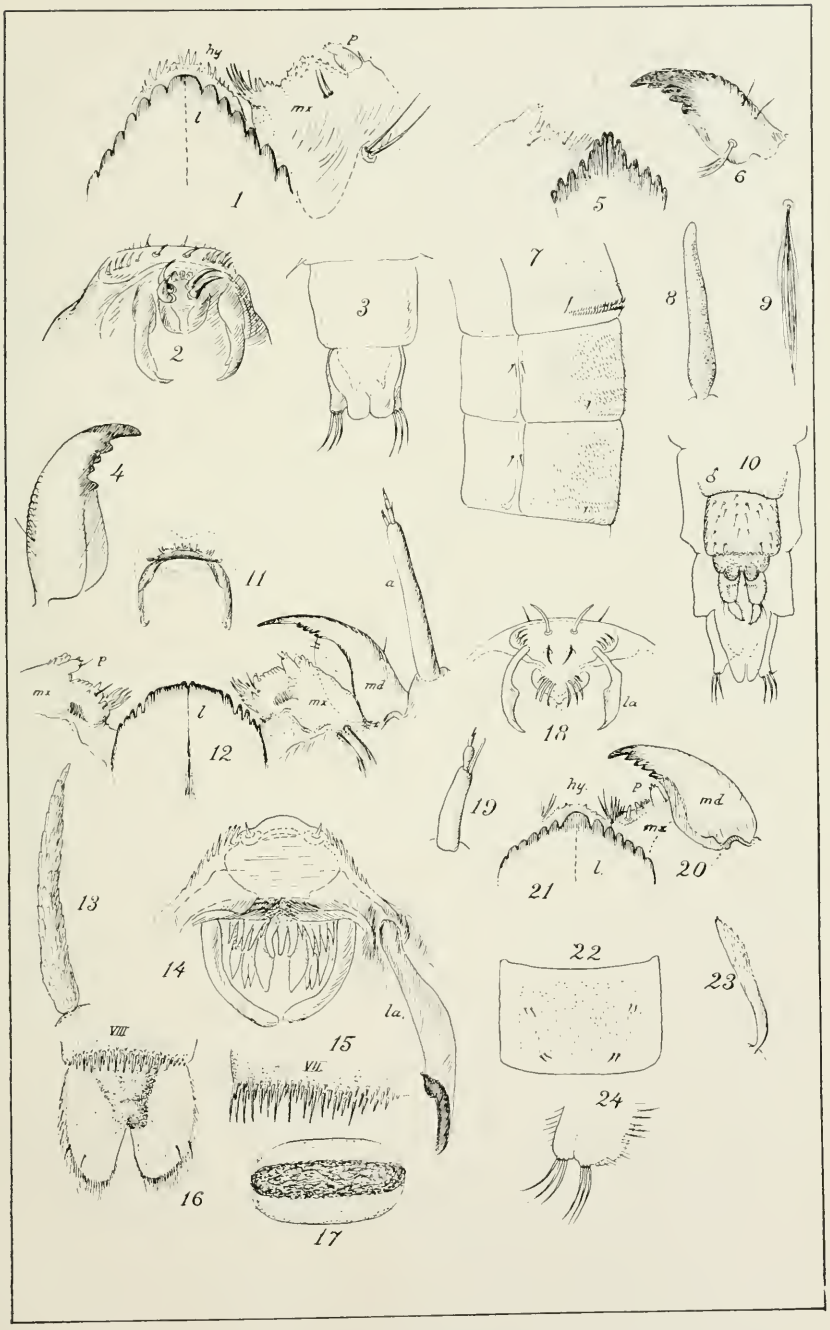


Chironomus: details of larva and pupa

Plate 23

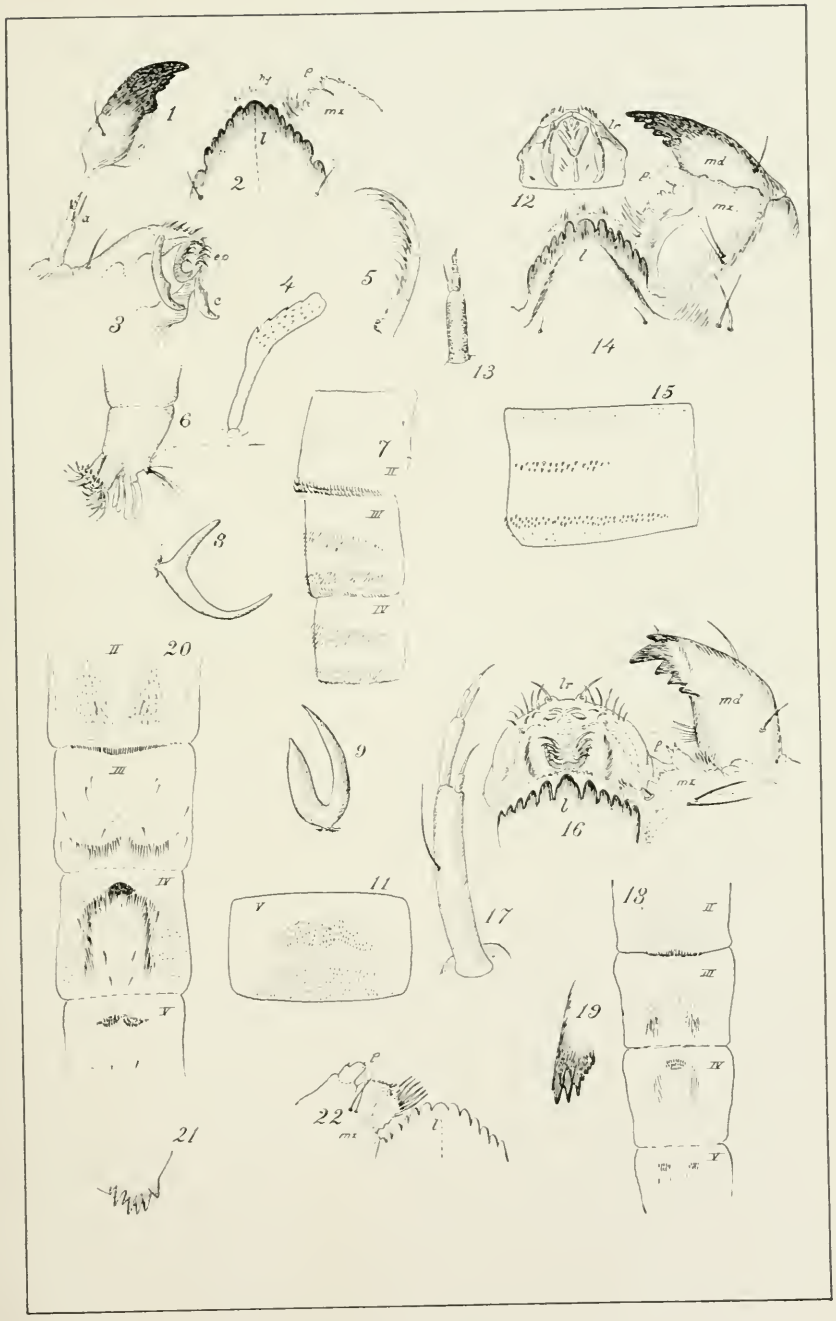


Chironomus: details of larva and pupa



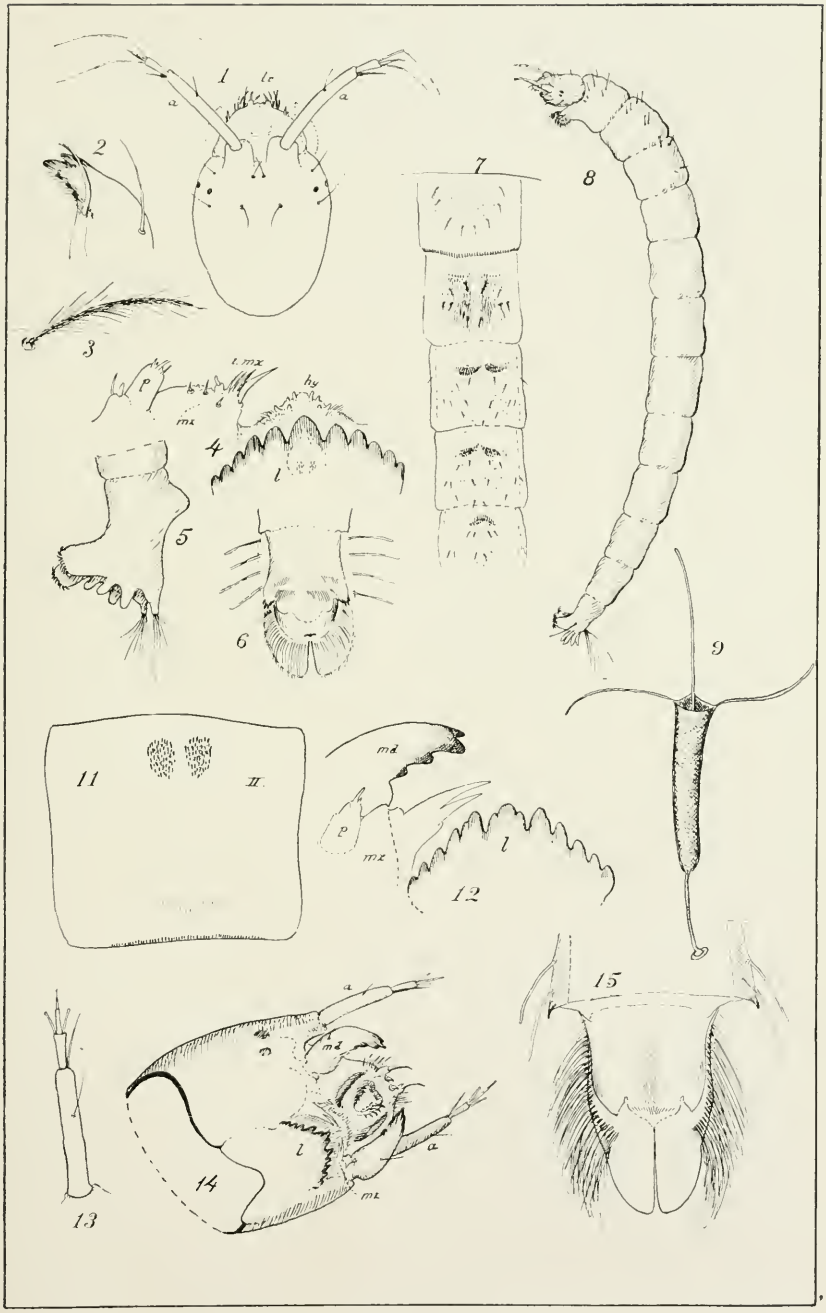
Cricotopus and Orthocladius

Plate 25



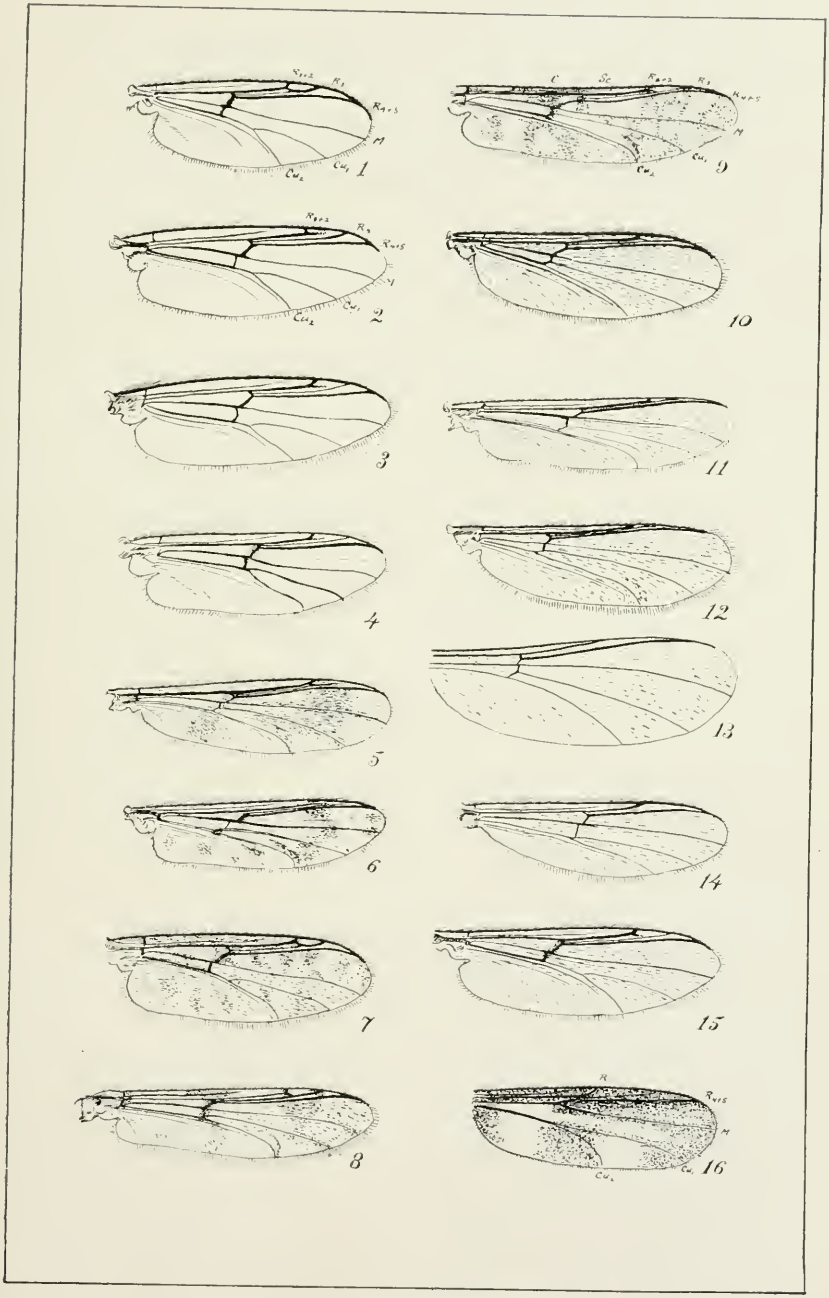
Orthocladius, Tanytarsus, Cricotopus

Plate 26



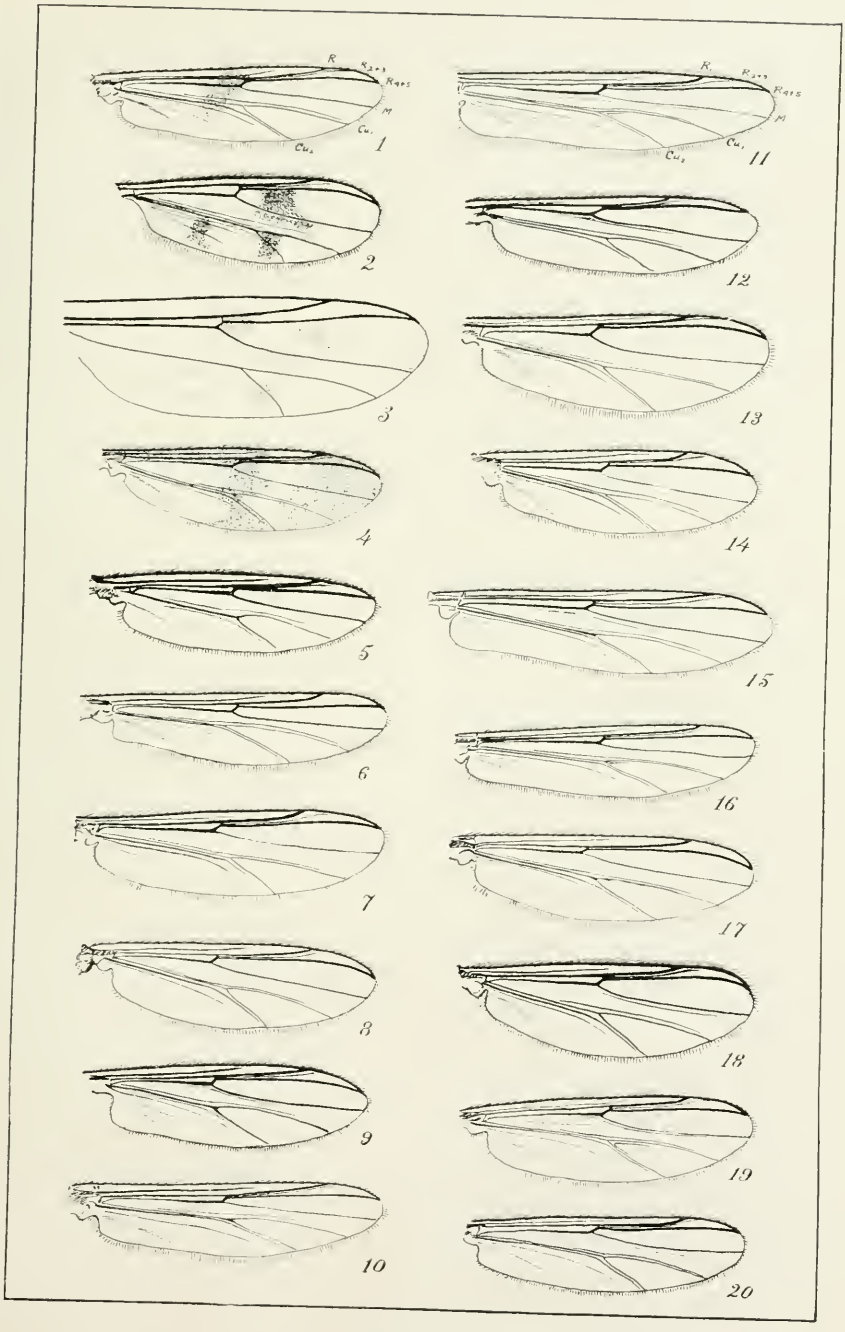
Tanytarsus

Plate 27



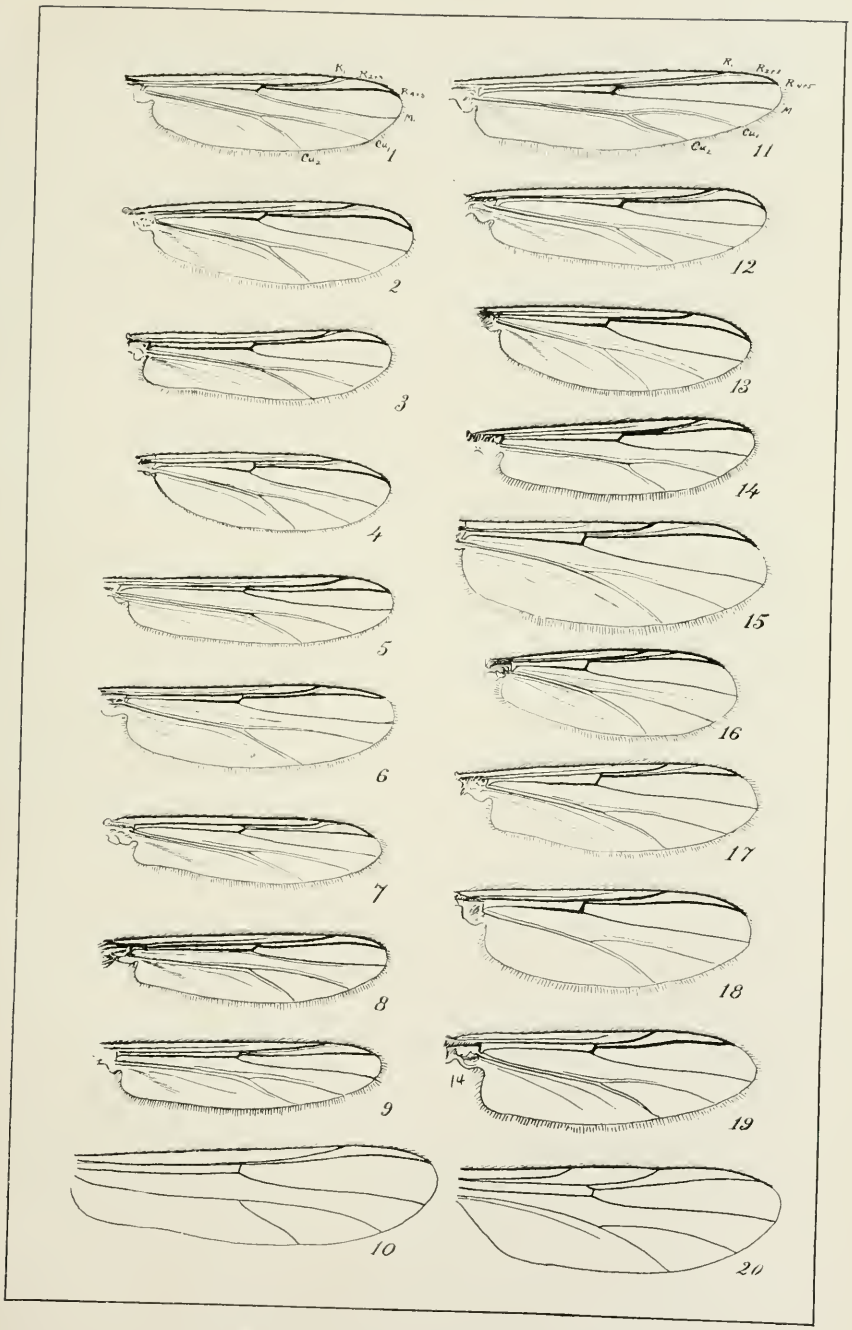
Tanypus group and Chasmatonotus

Plate 28

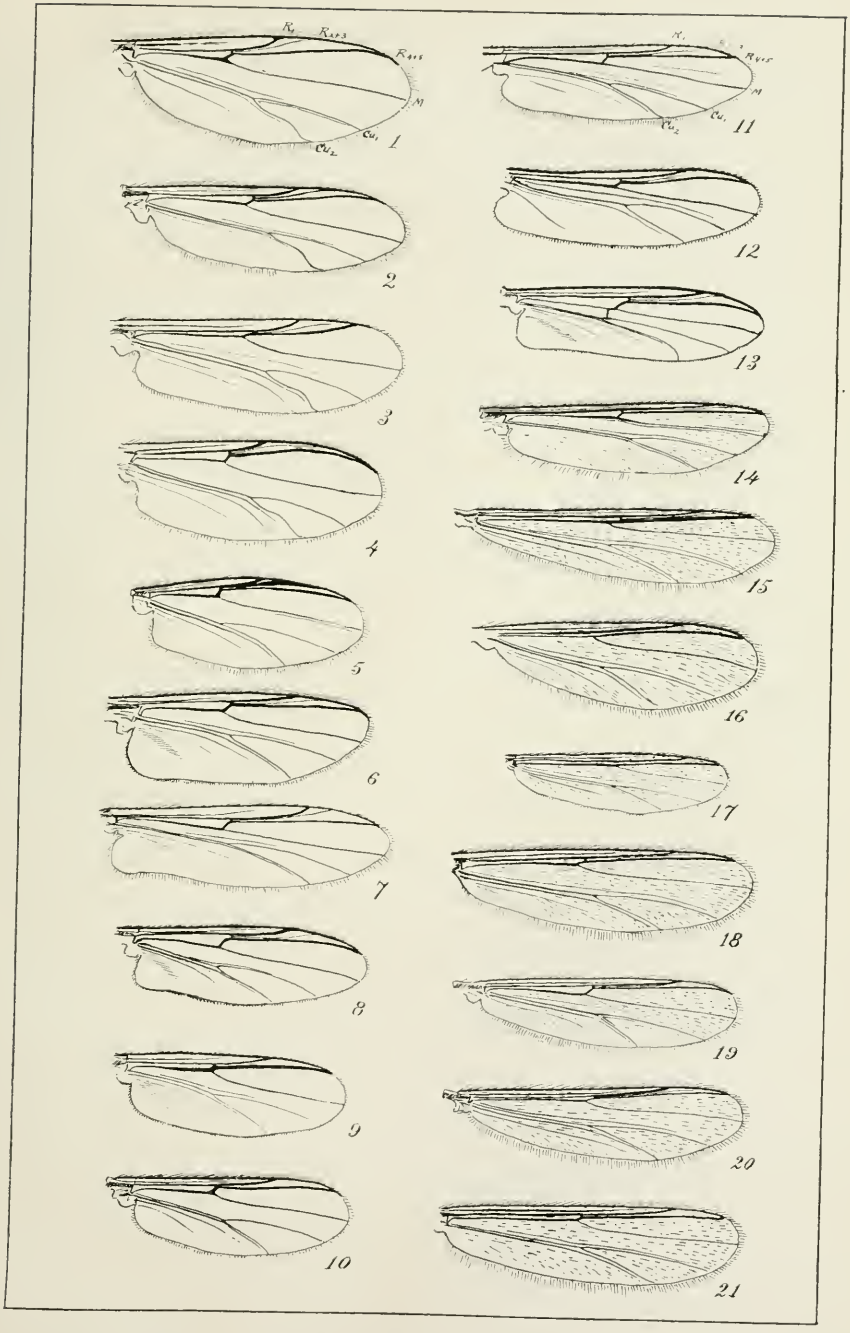


Chironomus

Plate 29

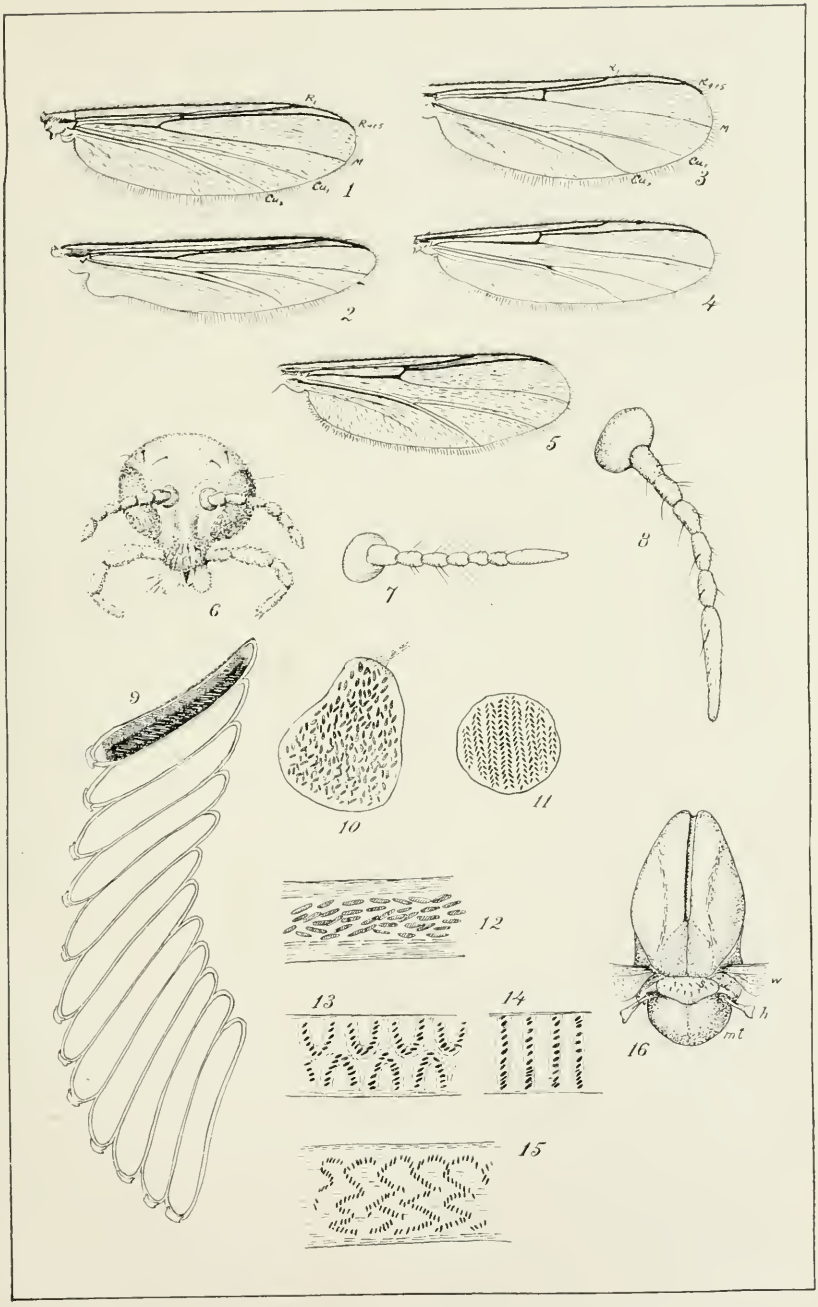


Chironomus (1 to 14), Cricotopus (15-20)



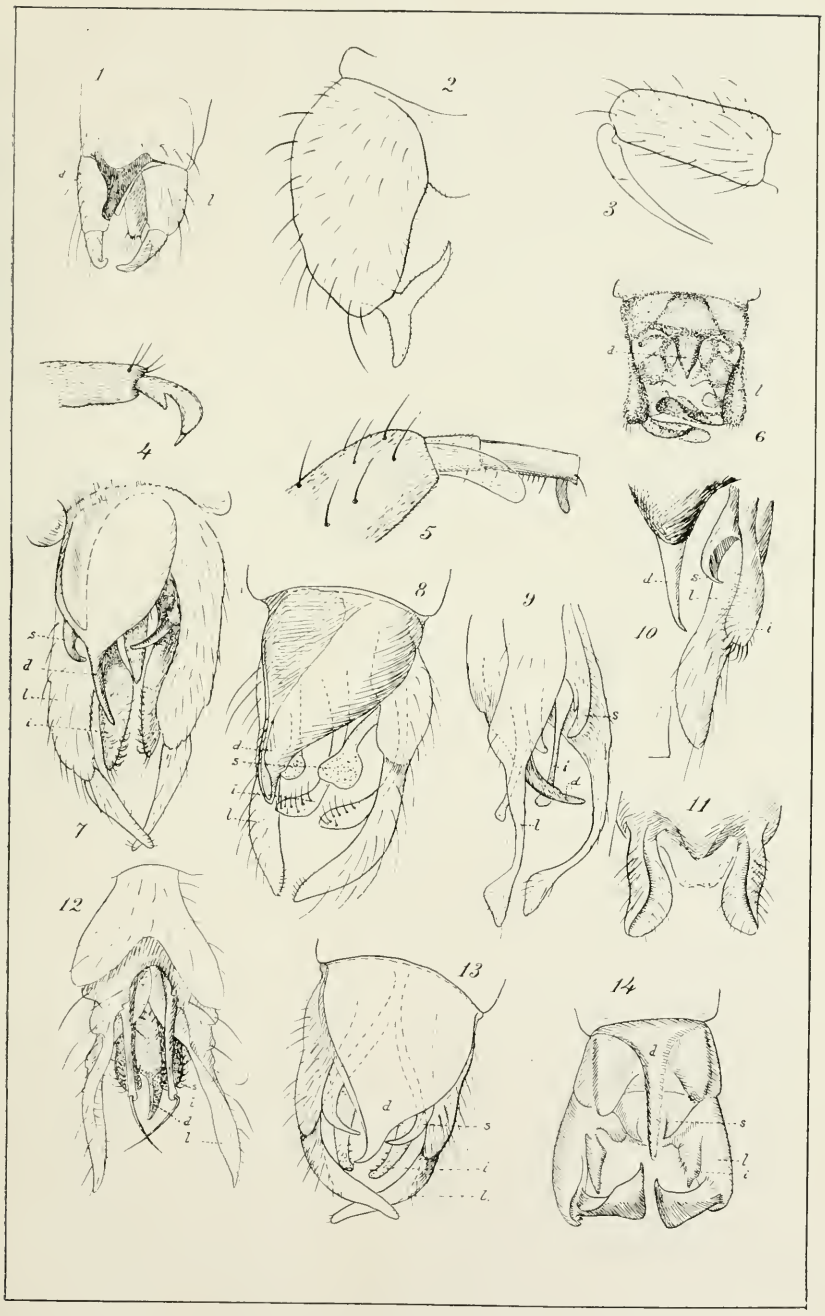
Camptocladius (1 to 4), Orthocladius (5 to 11), Thalassomyia (12), Diamesa (13), Tanytarsus (14 to 21)

Plate 31



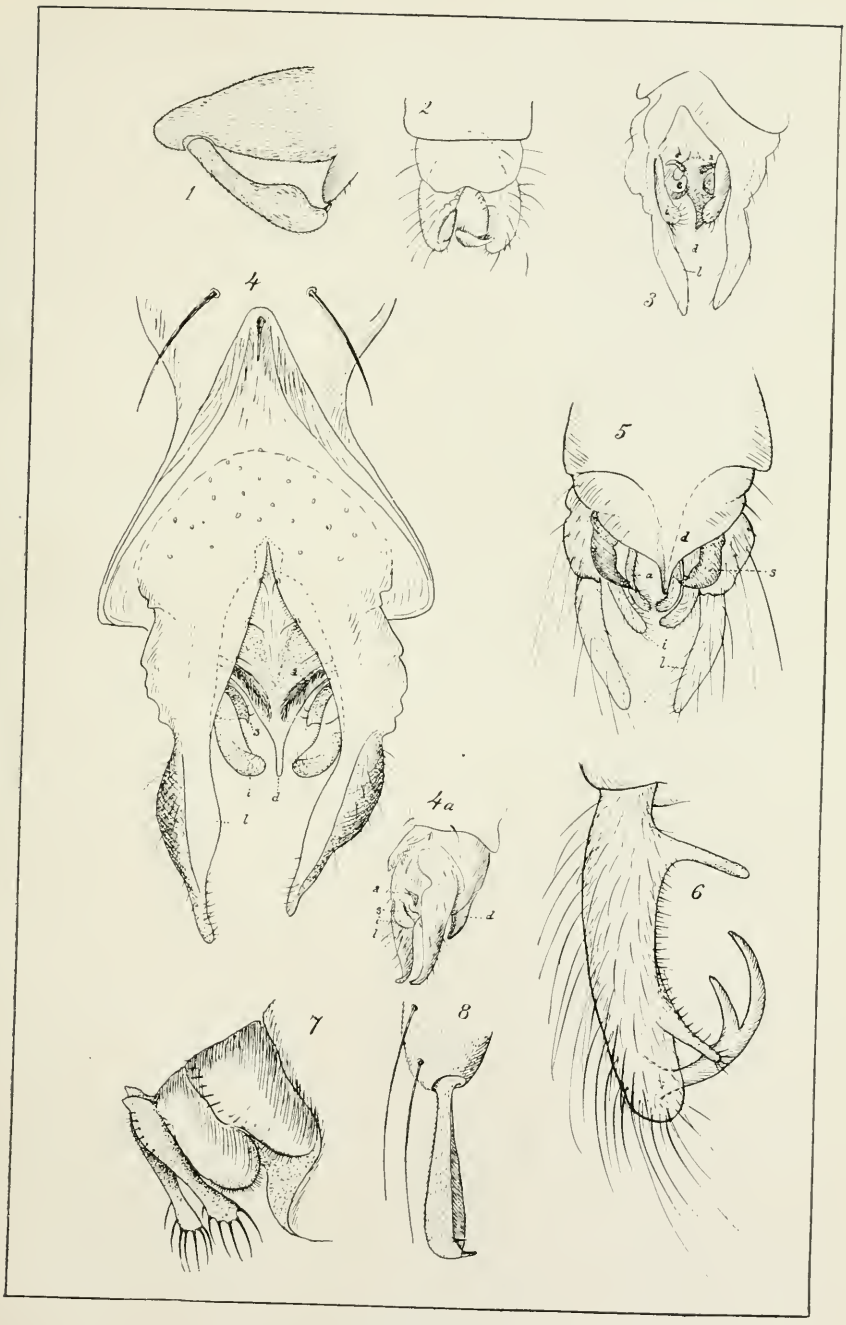
Metriocnemus (1 to 5), Chasmatonotus (6 and 16), Diamesa (7), Orthocladius (8), Eggs and egg masses (9 to 15)

Plate 32



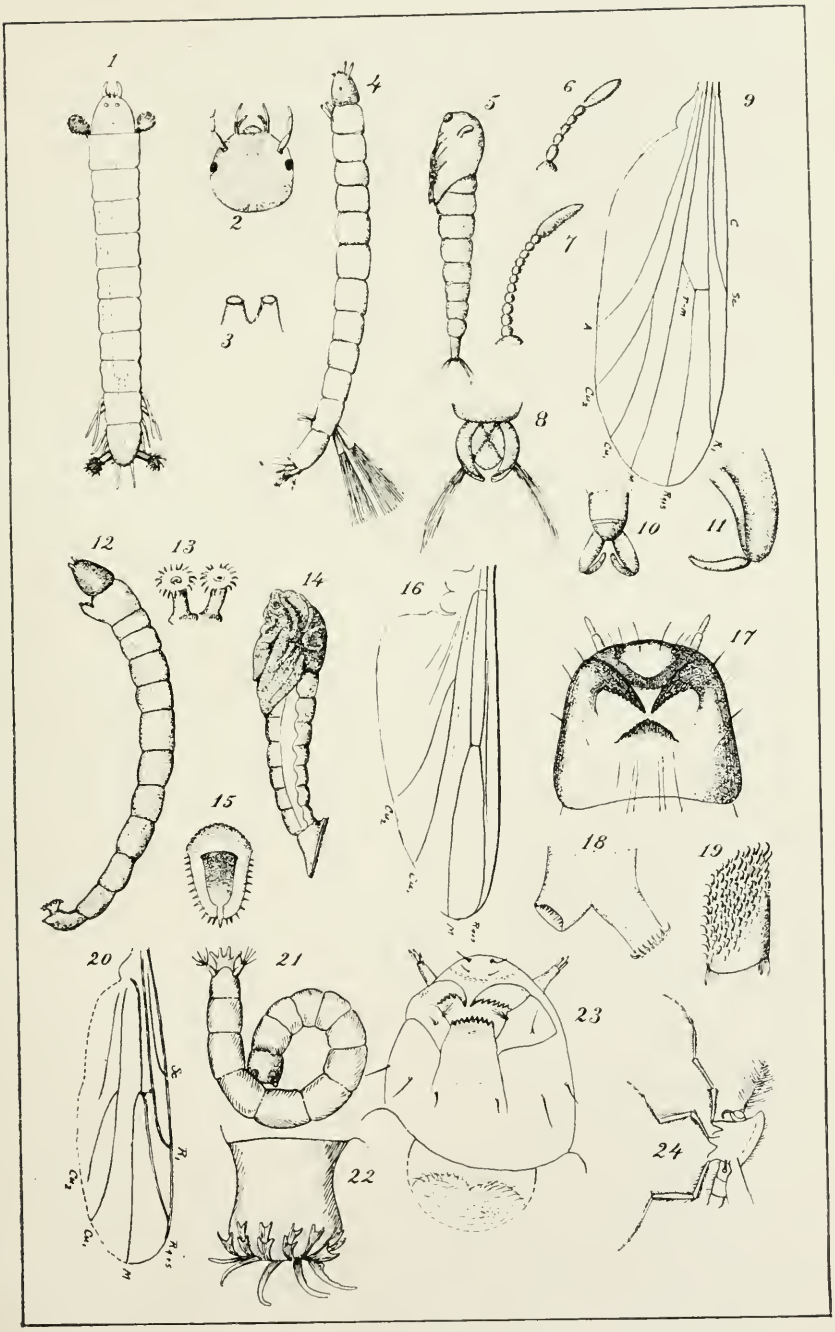
Genitalia

Plate 33

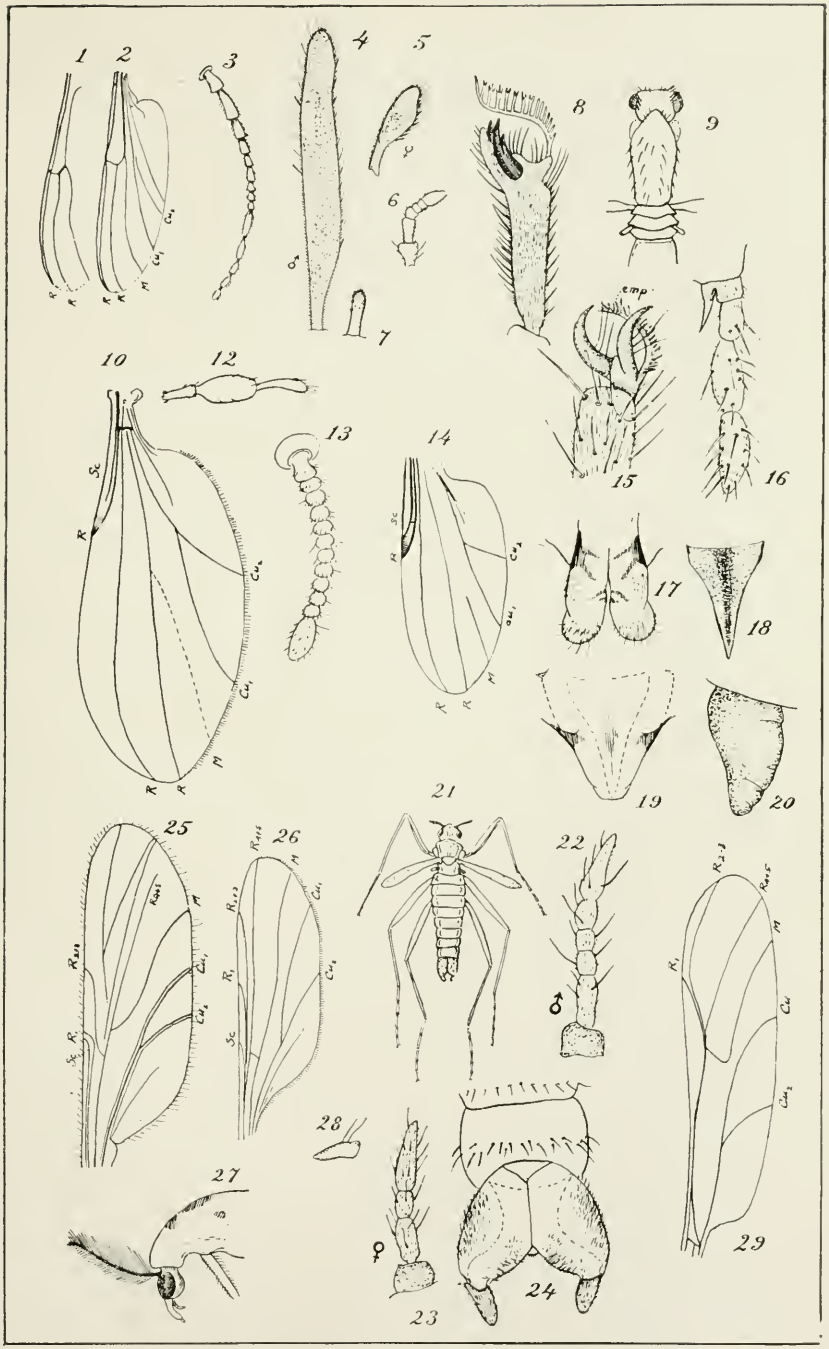


Genitalia

Plate 34

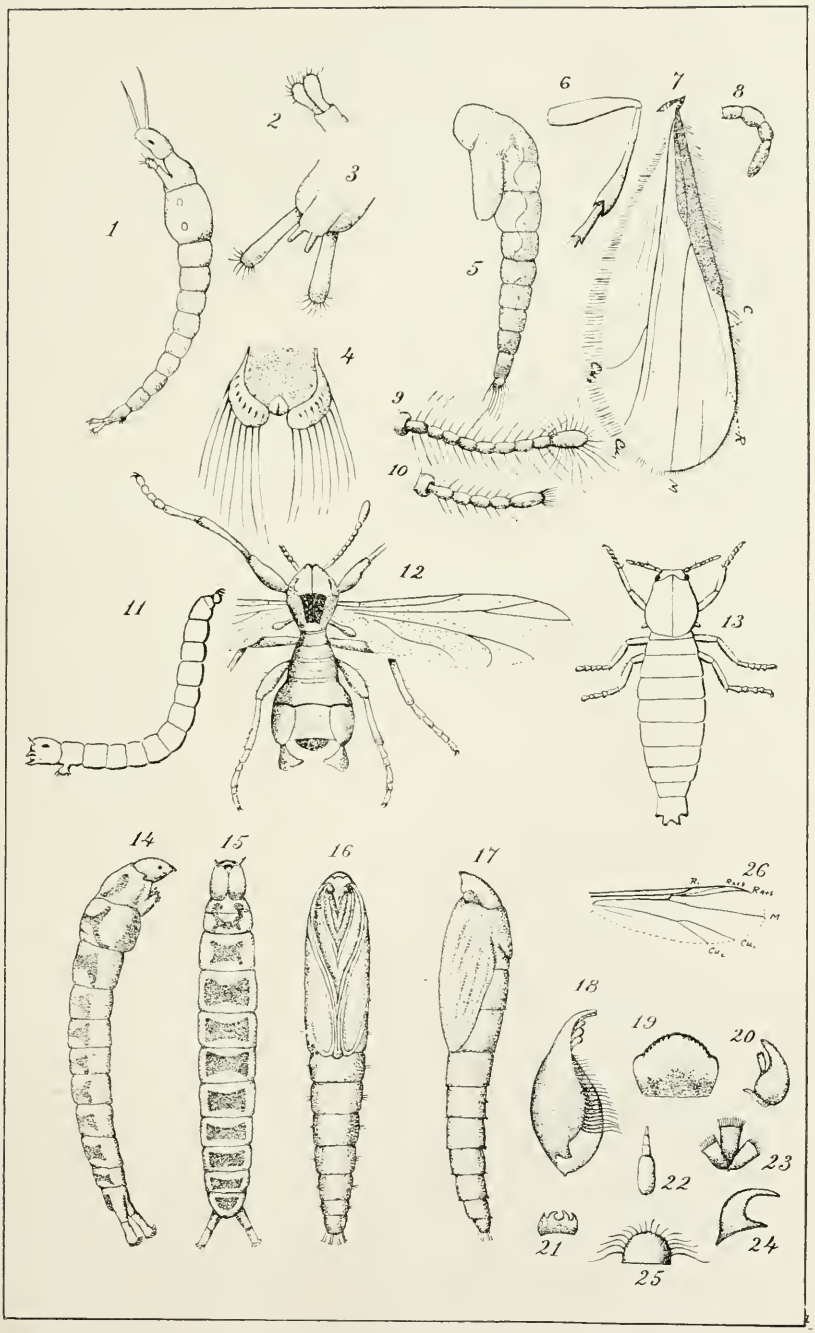


Miscellaneous details



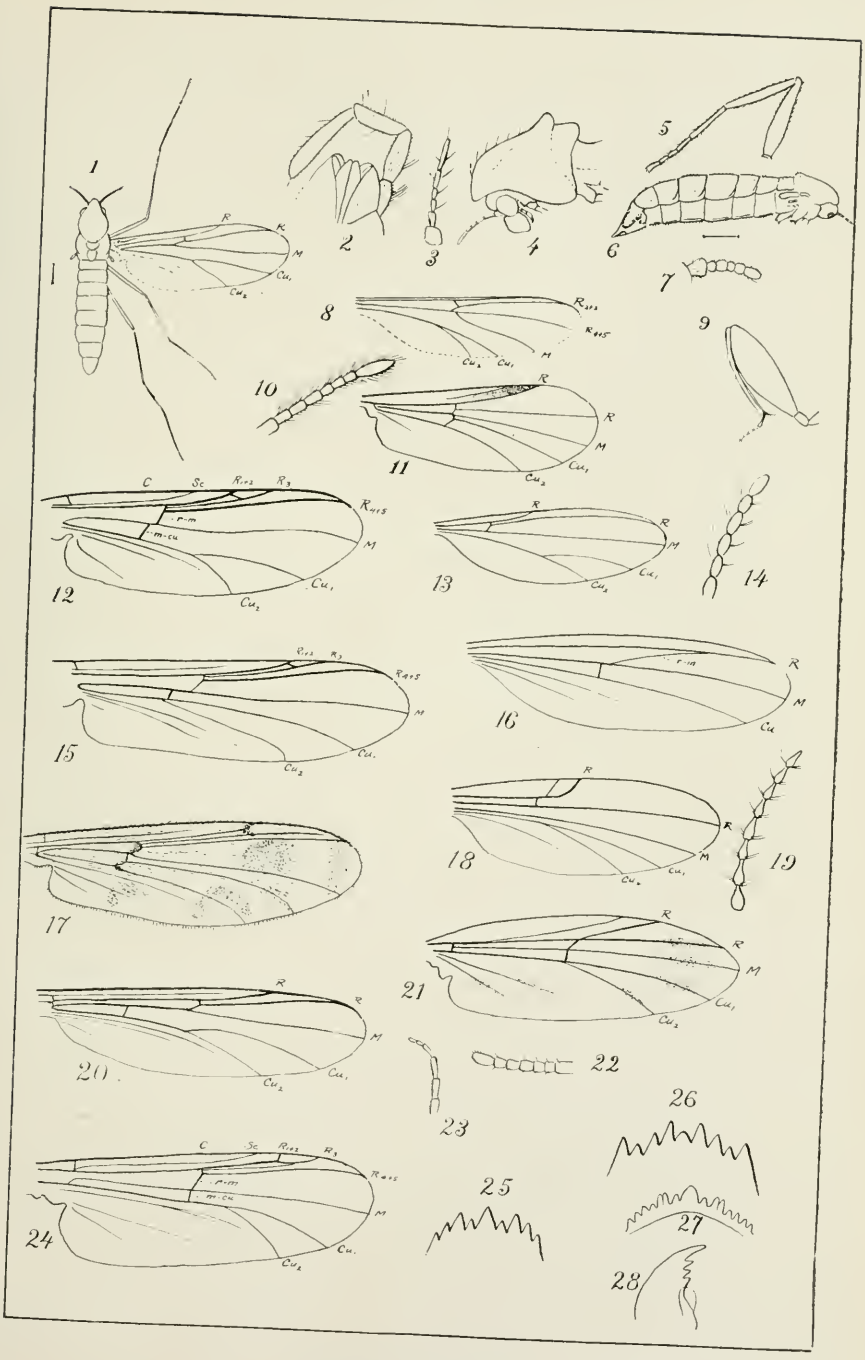
Miscellaneous details

Plate 36



Miscellaneous details

Plate 37



Miscellaneous details

INDEX

The superior figures tell the exact place on the page in ninths; e. g. 136^{3} means page 136, beginning in the third ninth of the page, i. e. about one third of the way down. Page numbers referring to descriptions of species are printed in black face type.

abdominalis, Chironomus, 243^{4}.
aberrans, Chironomus, *see* Chironomus aberrans.
aberrata, Diamesa, *see* Diamesa aberrata.
Ablabesmyia, 89^{7}, 121^{9}, 125^{7}, **135^{3}–55^{7}**, 156^{5}; key to species, 136^{1}–38^{8}.
(?) *sp.*, **155^{4}**; explanation of plate, 320^{6}.
adumbrata, 155^{4}.
algens, 137^{9}, **149^{1}**.
barberi, 137^{6}, **146^{5}**.
bifasciata, 136^{9}, **139^{4}**.
carnea, 136^{3}, 136^{6}, 137^{2}, **140^{4}–42^{8}**; explanation of plate, 321^{3}.
var. a, 137^{3}.
var. c, explanation of plate, 325^{4}.
discolor, 138^{1}, **149^{3}**.
dyari, 136^{7}, 137^{7}, **146^{9}–47^{8}**; explanation of plates, 320^{6}, 325^{5}.
fastuosa, 136^{4}, 136^{8}, 138^{6}, **153^{3}–54^{6}**; explanation of plate, 320^{6}.
flaveola, 138^{4}, **151^{4}**, 152^{4}.
flavifrons, 136^{4}, 136^{7}, 138^{3}, **150^{5}–51^{3}**; explanation of plates, 320^{4}, 325^{3}.
futilis, 137^{1}, **139^{7}–40^{4}**.
guttularis, 137^{6}, **145^{3}–46^{5}**.
hirtipennis, 138^{3}, **154^{6}**.
indecisa, 138^{6}, **152^{1}**; explanation of plate, 325^{3}.
johnsoni, 137^{3}, **147^{6}–48^{4}**.
melanops, 138^{2}, **149^{3}–50^{4}**; explanation of plate, 325^{3}.
monilis, 122^{3}, 136^{2}, 136^{9}, 137^{4}, 142^{3}–44^{3}, 153^{9}, 154^{1}, 156^{9}; explanation of plates, 320^{6}, 320^{7}, 325^{4}, 327^{3}.
nigropunctata, 138^{3}, 151^{3}, **155^{1}**.
Ablabesmyia ornata, 137^{5}, **148^{1}**.
pallens, 138^{5}, **151^{6}**.
var. a, explanation of plate, 325^{6}.
pictipennis, 136^{9}, **138^{3}–39^{4}**, 156^{2}, 156^{7}.
pilosella, 138^{4}, 138^{5}, **152^{8}–53^{3}**.
pulchripennis, 137^{3}, **142^{1}**; explanation of plate, 330^{6}.
tibialis, 138^{7}, **153^{3}**, 156^{4}, 156^{7}.
venusta, 137^{5}, **145^{1}**; explanation of plate, 325^{5}.
absurdus, Orthocladius, *see* Orthocladius absurdus.
Adams, C. F., cited, 310^{9}.
adumbrata, Ablabesmyia, 155^{4}.
adumbratus, Procladius, *see* Procladius adumbratus.
Aeschna, 14^{9}.
sp., 14^{7}.
Aesculus hippocastanum, 98^{7}.
aestivus, Chironomus, 299^{5}.
aestivus, Eurycnemus, 299^{2}.
Agraylea, 64^{6}, 64^{8}, 74^{1}.
cognatella, 75^{3}.
multipunctata, 73^{9}, **74^{2}–75^{3}**; explanation of figure, 331^{8}; figure, 73.
Agrioninae, 14^{7}.
Alasion, 93^{2}, 99^{4}.
rondani, **106^{4}**.
alaskensis, Telmatogeton, 169^{1}, **169^{3}**.
albimanus, Chironomus, *see* Chironomus albimanus.
albipennis, Chironomus, 194^{2}, **223^{4}**.
albistria, Chironomus, 198^{8}, 199^{2}, **246^{6}**.
albivitta, Pedicia, 8^{8}.
albomanicatus, Chirotenetes, *see* Chirotenetes albomanicatus.

albomarginatus, Ceratopogon, 107[8].
albus, Polymitarcys, *see* Polymitarcys albus.
Aldrich, acknowledgments to, 76[8].
algens, Ablabesmyia, 137[9], **149**[1].
allecta, Caenis, *see* Caenis allecta.
Allotrichia, 64[6], 64[9].
alternatus, Siphlurus, 15[2], 18[2], 19[2].
Ameletus, 25[9], 27[5], 30[2].
ludens, 18[5], **36**[2]–**38**[5]; explanation of plates, 316[3], 317[3]; figures, 36 37; explanation of figure, 331[2].
americana, ? Habrophlebia, 18[3].
americana, Orthotrichia, *see* Orthotrichia americana.
amiculus, Hemerobius, 15[5], 16[1].
amiculus, Palmobius, *see* Palmobius amiculus.
amphibius, Halirytus, 116[8].
Anatopynia, 89[7], 121[9], 125[5], 127[7], 130[5], 131[5], **135**[5].
consobrinus, 135[7].
forcipatus, 135[7].
humeralis, 135[7].
lactipennis, 135[7].
morio, 135[7].
nudipes, 135[7].
pubitarsis, 135[7].
Anax, 14[9].
junius, 14[7].
angulatus, Micromus, 15[6].
angustella, Orthotrichia, *see* Orthotrichia angustella.
annularis, Chironomus, *see* Chironomus annularis.
annulatus, Chironomus, 213[1].
annulatus, Tanypus, *see* Tanypus annulatus.
annulipes, Tanypus, 161[8].
anonymus, Chironomus, 190[4], 196[0], **235**[2].
antarctica, Belgica, 113[6].
anticus, Chironomus, 199[7], **247**[7].
Ants, 11.
Apogon, 106[5].
Aquatic Nematocerous Diptera, 76–315.
arcticus, Chironomus, 304[8].
argentata, Ceratopogon (Sphaeromias), *see* Ceratopogon (Sphaeromias) argentata.
argentatus, Sphaeromias, *see* Sphaeromias argentatus.
Argia violacea, 14[6].
Aristotles, cited, 310[9].
Arribalzaga, F. L., cited, 109[5], 109[8], 172[6], 259[4], 310[9].
arundineti, Tipula ?, 149[6].
Asper, cited, 310[9].
aterrimus, Camptocladius, 259[7], **261**[4].
aterrimus, Chironomus, 264[4], 304[9].
Atherix *sp.*, 9[1].
atomarius, Orthocladius, 266[7], **276**[8]–**77**[2].
atra, Corynoneura, **164**[1], 164[5].
atratulus, Metriocnemus, *see* Metriocnemus atratulus.
atricornis, Chironomus *var.*, 218[5].
atrimanus, Chironomus, 190[6], 200[1] **200**[7]–**1**[1].
attenuatus, Chironomus, 198[5], **245**[5].

badius ?, Stratiomyia, 13[9].
Baetinae, 24[3], 27[2], 29[4], 29[5], 29[6].
Baetini, 29[9].
Baetis, 26[6], 27[9], 29[6], 32[3], 38[7].
pygmaea, 18[1], **40**[4].
Baetisca, 24[3], 27[3], 29[7].
obesa, 17[9], **30**[4]–**31**[4]; explanation of plate, 316[1]; figure, 30; explanation of figure, 331[2].
Balbiani, cited, 310[9], 311[4].
baltimoreus, Tanypus, 156[8], **160**[5].
Banks, C. S., mentioned, 234[2].
Banks, Nathan, cited, 73[1].
barberi, Ablabesmyia, 137[6], **146**[5].
barbicornis, Orthocladius, 266[6], **283**[5].
barbipes, Chironomus, *see* Chironomus barbipes.
basalis, Choroterpes, *see* Choroterpes basalis.
basalis, Orthocladius, 267[7], **282**[3].
Becker, cited, 311[1].
Bees, 11.
Belgica, 89[3], **112**[8]–**13**[6].
antarctica, 113[6].
magellanica, 113[6].

Beling, cited, 8[9].
bellus, Procladius, 126[5], 128[5], 128[7]–29[3].
bellus, Tanypus, 128[3].
Bergroth, cited, 311[1].
Berkeley, cited, 311[2].
Berotha, 16[7].
Berry, Edward W., cited, 18[3], 40[7].
Betten, Cornelius, material collected by, 19[6], 63[2].
Beuthin, cited, 162[5], 311[3].
Bezzi, cited, 106[7].
Bezzia, 92[3], 99[4], 102[6]; explanation of plate, 319[8].
sp., 103[7]–4[1]; explanation of plate, 319[7].
setulosa, 102[3]–3[7], 103[3]; explanation of plates, 319[9], 320[7], 320[8], 327[5].
Bibliography of Chironomidae, 310[8]–15[9].
bicinctus, Cricotopus, *see* Cricotopus bicinctus.
bicolor, Tanypus, 149[9].
bifasciata, Ablabesmyia, 136[9], 139[4].
bimacula, Chironomus, 199[8], 247[9]–48[1].
bimaculatus, Chasmatonotus, *see* Chasmatonotus bimaculatus.
bipunctata, Forcipomyia, 100[9].
bipunctatus, Ceratopogon, 100[1].
bispina, Ephemerella, *see* Ephemerella bispina.
bivittata, Spaniotoma, 162[8].
Blackwings, 14[6].
Blasturus, 24[9], 27[4], 32[4].
cupidus, 18[3], 40[8]–41[5]; figure, 41; explanation of figure, 331[8].
Blepharocera, 54[2], 59[1].
Blepharoceridae, 76[2], 79[4].
Blood worms, 79[1], 123[8].
Bohemann, cited, 311[2].
Bolton, mentioned, 69[1].
Bombus consimilis, 13[4].
ternarius, 13[4].
borealis, Chironomus, 198[7], 245[1], 246[8].
borealis, Eutanypus, 178[8], 178[9]–79[5].
Bouche, cited, 311[2].
brachialis, Chironomus, *see* Chironomus brachialis.
brachiata, Orthotrichia, *see* Orthotrichia brachiata.
Brachypogon, 92[9], 99[4], 104[5]; explanation of plate, 319[7].
Brauer, F., cited, 311[2].
Bremi, cited, 311[3].
brevipennis, Chironomus, 172[1].
brevipennis, Smittia, 172[4].
brevitibialis, Chironomus, 194[7], 226[9]–27[3], 230[5].
Brodie, cited, 77[8].
Brook trout, food of, 7[7].
Brown, J. C., mentioned, 113[9].
browni, Eretmoptera, 114[8]–15[9], 118[7].
brunneipennis, Chironomus, 191[4], 191[8], 205[2].
brunneus, Chironomus, 198[8], 199[4], 246[9]–47[1].
brunnipes, Chironomus, 191[4], 193[1], 204[7]–5[2].
Bullfrog, summer food of, at Saranac Inn, by J. G. Needham, 9[2]–15[5].
Bumble bees, worker, 13[4].
Burmeister, cited, 78[2].
Burmeisteria, 91[5], 172[4]; explanation of plate, 329[3].
photophila, 172[7].
byssinus, Camptocladius, 261[6], 264[7].

Caenini, 29[9].
Caenis, 19[4], 25[4], 27[6], 32[8], 36[2], 38[7].
allecta, 18[5], 47[8]–49[3]; figures, 48, explanation of figures, 331[4].
diminuta, 18[2], 48[9], 49[9]; explanation of plate, 317[9].
hilaris, 49[3].
hilaris, 47[9], 49[6]; explanation of plate, 317[9], 318[1].
californicus, Chironomus, 192[7], 217[5].
caliginosus, Chironomus, *see* Chironomus caliginosus.
caliginosus, Procladius, *see* Procladius caliginosus.
Callibaetis, 26[1], 28[1]; explanation of figure, 331[4]; wings of, figure, 21.
ferruginea, 18[3].
skokiana, 18[3], 40[6].
Calopteryx maculata, 14[6].

Cambarus, 13[1].
Camponotus pennsylvanicus, 13[3].
Campsurus, 22[9], 26[6].
Camptocladius, 91[8], 172[3], **259[1]–64[8]**, 265[1], 303[5]; key to species, 259[5]–60[9].
sp., 259[6], **260[3]**; explanation of plate, 326[8].
aterrimus, 259[7], **261[4]**.
bysinnus, 260[1], **262[1]**; explanation of plate, 326[6].
extremus, 260[8], **264[3]**.
fumosus, 259[7], 260[6], **261[1]**; explanation of plate, 326[3].
graminicola, 259[5], **260[3]**, 300[5].
minimus, 259[5], **262[8]–63[3]**; explanation of plate, 326[6].
parvus, 260[2], **263[3]**.
pumilio, 259[9], **261[7]–62[3]**.
velutinus, 260[2], **263[7]–64[3]**.
cantans, Tipula, 218[5].
Carabidae, 11, 13[5].
carnea, Ablabesmyia, *see* Ablabesmyia carnea.
Carpenter, G. H., cited, 120[7], 311[3].
catesbiana, Rana, *see* Rana catesbiana.
Cecidomium grandaevum, 77[3].
celeripes, Corynoneura, *see* Corynoneura celeripes.
Centroptilum, 26[3], 27[9].
Ceratolophus, 93[1], 99[4], 104[8], **104[9]–5[3]**, 106[4].
sp., **105[3]**.
Ceratopogon (group), 76[4], 77[3], 78[8], 87[2], 88[3], 92[5], 94[5], 94[7], **97[1]–121[8]**.
Ceratopogon (genus), 13[9], 78[1], 80[4], 83[1], 83[4], 84[1], 92[6], 92[7], 101[2], 101[7], 102[8], 111[5], 111[7], 112[3], 283[3].
seus. lat., explanation of plates, 319[5], 319[6], 320[1].
seus. str., 99[9]–101[3].
sp., **100[2]**.
sp. seus. lat., **110[3]**, 110[8]–11[1].
albomarginatus, 107[8].
(Sphaeromyas) argentata, 122[3].
bipunctatus, 100[1].
fasciata, 104[7].
fasciatus, 107[3].
Ceratopogon femoratus, 105[2], 108[4].
flavipes, 106[5].
hortulanus, 106[9].
ornata, 102[7].
punctata, 101[5].
rostratus, 112[7].
vitiosus, 104[5].
Chagnon, cited, 311[3].
Chasmatonotus, 84[7], 90[9], 93[3], **166[3]**, 297[4]; key to species, 166[5].
bimaculatus, 166[5], **166[7]–67[3]**; explanation of plates, 325[6], 327[2], 327[4], 327[6].
maculatus, 167[3].
unimaculatus, 166[7], 167[1], **167[6]**.
univittatus, 166[9], **167[4]**.
Chevrel, cited, 308[2], 311[3].
Child, cited, 311[3].
chiopterus, Chironomus, 276[9].
Chironomidae, 7[8], 13[7], 76–310; bibliography, 310[8]–15[9]; characteristics of egg, larva, pupa and adult, 81[2]–86[9]; economic importance, 78[5]–79[2]; enemies, 79[2]; geological distribution, 77[7]–78[5]; key to genera, 87[1]–94[5]; methods of capturing, rearing and mounting, 79[4]–81[2]; North American, key to genera, 93[5]–94[5].
Chironomus (group), **179[3]–308[9]**.
Chironomus (genus), 13[8], 77[3], 78[1], 78[3], 80[4], 80[9], 83[3], 84[1], 84[9], 85[5], 87[8], 88[4], 91[5], 91[7], 98[7], 121[3], 122[1], 122[9], 123[5], 123[9], 124[1], 127[3], 133[7], 140[4], 142[8], 158[9], 162[7], 164[8], 170[8], 171[6], 172[1], 172[4], 172[9], 173[4], 174[5], **186[1]–250[7]**, 251[2], 252[8], 256[7], 257[8], 258[1], 259[3], 260[3], 261[4], 261[7], 262[4], 262[9], 263[8], 264[3], 265[4], 268[4], 269[1], 272[5], 274[3], 276[5], 276[8], 277[2], 278[3], 278[8], 281[1], 282[3], 283[3], 284[2], 287[7], 288[9], 290[9], 291[5], 296[8], 296[9], 299[1], 299[3], 299[7], 301[3], 302[5], 304[1], 304[4], 304[8], 305[5]; key to species, 188[3]–99[9].
sp., 188[6], 188[7], 188[9], 189[1], 235[4], **248[8]–50[7]**, **309[1]–10[7]**; explanation of plates, 319[4], 322[3], 322[8], 323[3], 327[3], 330[9]; figures, 309.
seus. lat. sp., explanation of plate, 321[4].

Chironomus abdominalis, 243[4].
aberrans, 193[4], **221**[3]; explanation of plate, 325[9].
aestivus, 299[5].
albimanus, 192[4], 205[3], **214**[2]; explanation of plate, 325[9].
albipennis, 194[2], **223**[4].
albistria, 198[8], 199[2], **246**[6].
annularis, 190[4], 192[8], 211[5], **212**[9]–**13**[9], 214[3], 237[2]; explanation of plate, 325[8].
annulatus, 213[1].
anonymus, 190[4], 196[9], **235**[3].
anticus, 199[7], **247**[7].
arcticus, 304[8].
aterrimus, 264[4], 304[9].
var. atricornis, 218[5].
atrimanus, 190[6], 200[1], **200**[7]–**1**[1].
attenuatus, 198[5], **245**[3].
barbipes, 192[2], **212**[2]; explanation of plate, 325[8].
bimacula, 199[8], **247**[9]–**48**[1].
borealis, 198[7], 245[1], **246**[3].
brachialis, 190[6], 192[9], **200**[1], 240[3]; explanation of plate, 325[7].
brevipennis, 172[1].
brevitibialis, 194[7], **226**[9]–**27**[3], 230[5].
brunneipennis, 191[4], 191[8], **205**[2].
brunneus, 198[8], 199[4], **246**[9]–**47**[1].
brunnipes, 191[4], 193[1], **204**[7]–**5**[2].
californicus, 192[7], **217**[3].
caliginosus, 191[5], 193[3], **205**[5]; explanation of plate, 325[7].
chiopterus, 276[3].
chloris, 190[4], 192[5], 193[5], **216**[2].
cingulatus, 240[9].
confinis, 199[9], **248**[2].
crassicollis, 198[5], **245**[1].
cristatus, 197[9], 236[3], 242[3], **242**[1]–**43**[2]; explanation of plate, 326[4].
decorus, 188[5], 189[5], 197[6], 212[1], 233[3], **239**[3]–**40**[5], 248[9], 250[2]; explanation of plates, 323[3], 326[4], 327[7].
devinctus, 192[6], **216**[8]–**17**[4]; explanation of plate, 325[9].
dispar, 192[4], **213**[7].
diversus, 190[3].
Chironomus dizonias, 256[4].
dorsalis, 179[7], 188[8], 197[7], **240**[9]–**41**[8]; explanation of plates, 323[1], 327[3].
dux., 188[6], 190[3], 195[6], **231**[3]; explanation of plate, 326[3].
elegans, 299[5].
fallax, 191[9], **210**[8]–**11**[3], 221[4]; explanation of plate, 325[8].
fascipennis, 191[5], **203**[2], 204[3].
ferrugineovittatus, 197[5], **238**[7]–**39**[2].
festivus, 196[3], **234**[3], 242[4].
fimbriatus, 198[9], 198[8], **245**[8].
flavicingula, 188[5], 189[9], 191[8], **208**[2]–**10**[2], 217[3], 249[5], 249[6]; explanation of plates, 321[8], 325[8], 327[3].
flavus, 189[3], 189[7], 194[9], **225**[2]–**26**[3]; explanation of plates, 322[1], 326[1], 327[7].
frequens, 195[4], **230**[5]; explanation of plate, 326[3].
frigidus, 281[2].
fulviventris, 189[2], 189[8], 195[2], 196[6], 196[8], **229**[3]; explanation of plates, 322[7], 322[9], 326[3], 327[9].
fulvus, 189[5], 194[5], **224**[3]–**25**[2]; explanation of plates, 322[7], 322[8], 326[1].
fumidus, 193[8], **221**[9]–**22**[5]; explanation of plate, 326[1].
glaucurus, 241[9].
grandis, 237[2].
halteralis, 191[8], **210**[2], 222[4]; explanation of plate, 325[8].
hilaris, 199[4], **247**[4].
hirtipes, 299[5].
hyperboreus, 191[0], **206**[8]–**7**[4], 207[5], 245[1], 246[6].
innocuus, 196[9], **235**[8]–**36**[2].
intermedius, 244[4].
jucundus, 195[3], 198[9], **232**[7].
lasiomerus, 199[6].
lasiopus, 199[1], 199[5], **247**[2].
lineatus, 194[1], 196[2], **223**[1].
lineola, 196[2], 223[2], **234**[8].
lobifer, 233[5].
lobiferus, 188[9], 189[9], 195[9], **233**[1]–**34**[5]; explanation of plate, 323[2].
longimanus, 195[9], 196[5], 221[7], **233**[1]; explanation of plate, 326[4].
longipes, 222[5].

Chironomus lugubris, 193[8], **221**[7].
modestus, 188[9], 189[5], 194[8], **227**[4]–29[2], 231[4]; explanation of plates, 322[3], 326[2], 327[6], 327[7].
var., 189[6], 194[9].
var., a, 190[2]; explanation of plates, 322[6], 326[3].
var. b, explanation of plates, 322[5], 326[2], 327[6].
nanus, 302[9].
nigricans, 189[8], 190[2], 192[8], 193[3], **219**[5]–21[3], 223[9]; explanation of plates, 321[6], 325[9].
nigritibia, 198[6], **246**[1].
nitidellus, 191[9], **210**[6].
niveipennis, 191[6], **205**[9]–7[4].
niveipes, 217[5].
nivoriundus, 176[5].
nubeculosus, 190[5].
obscurus, 206[2], 283[4].
oceanicus, 199[3].
octopunctatus, 190[3], **201**[5].
pallens, 212[3], 213[2].
palliatus, 192[8], 193[7], **217**[9]–18[3].
pallidus, 195[3], **230**[1]; explanation of plate, 326[3].
pavidus, 282[4].
pedellus, 192[9], 193[8], **218**[3], 219[2], 219[4]; explanation of plate, 325[9].
pedestris, 193[1], **219**[1].
pellucidus, 199[9], **248**[5].
pilicornis, 206[2].
pilipes, 244[5].
plumosus, 188[5], 189[7], 197[4], **236**[9]–38[7], 250[2]; explanation of plates, 323[5], 326[4].
polaris, 198[4], 206[7], **244**[3]–45[3].
prasinus, 188[8], 198[2], **244**[3]; explanation of plate, 330[8].
pulchripennis, 191[5], 203[5], **204**[4].
redeuns, 197[5], **236**[6].
riparius, 190[4], 192[2], **211**[3]–12[2]; explanation of plate, 325[8].
rudis, 206[2].
scalaenus, 190[8], **201**[9]–2[8]; explanation of plate, 325[7].
similis, 197[2], 197[8], **236**[2]; explanation of plate, 326[1].
spilopterus, 190[9], **202**[8]–3[1]; explanation of plate, 325[7].
Chironomus staegeri, 191[7], **207**[4]–8[2], 245[1], 246[6].
stigmaterus, 197[7], **241**[8]–42[4].
taeniapennis, 191[2], **203**[5], 204[3], 204[4]; explanation of plate, 325[7].
taenionotus, 194[3], **223**[9]–24[2].
tendens, 193[9], 196[4], **222**[5], 230[9], 234[9], 242[4].
tenellus, 188[6], 189[5], 192[5], 193[6], **214**[7]–16[1]; explanation of plate, 321[5].
tentans, 188[3], 190[4], 198[1], **243**[3]–44[3]; explanation of plate, 330[9].
triannulatus, 258[1].
trichomerus, 199[9], **248**[6].
tricinctus, 253[7].
tristis, 213[5].
unicolor, 199[7].
variabilis, 272[6].
varipennis, 190[7], **201**[1].
venustus, 241[1].
vernalis, 243[4].
vernus, 291[1].
vibratorius, 258[1].
virescens, 190[4].
viridicollis, 195[7], 197[8], **232**[1]; explanation of plate, 326[3].
viridipes, 211[5].
viridis, 195[5], 227[1], **230**[7].
vulneratus, 230[9].
waldheimii, 241[2].
willistoni, 196[7], **235**[1].
zonulus, 211[5].
Chirotenetes, 25[7], 27[7], 28[8], 29[3], 30[1], 32[2], 36[2], 37[2].
albomanicatus, 18[4], 29[1], **31**[5]–36[2], 54[4]; explanation of plates, 316[5], 316[6].
ignotus, 28[9].
Chloeon, 26[3].
chloris, Chironomus, *see* Chironomus chloris.
chorea, Diamesa, 174[8], **176**[9]–77[4].
choreus, Tanypus, 156[7], **159**[6]–60[2].
Choroterpes, 25[2], 27[4], 32[4].
basalis, 18[7], **38**[5]–40[4]; explanation of plates, 316[9], 317[2].
Chrysomelidae, 7[7], 13[8].
cinctus, Tanypus, 125[6], 155[9].
cinerea, Molanna, 14[4].
cingulatus, Chironomus, 240[9].

claripennis, Orthocladius, 267[2], 278[2].
clavata, Ithytrichia, *see* Ithytrichia clavata.
clepsydrus, Orthocladius, 266[5], **283[3]–84[1]**.
Climacia, 16[6].
  dictyona, 15[5].
Cloeon, 28[2].
Clunio, 89[2], 90[4], **120[2]–21[8]**.
  marinus, 120[8]; explanation of plate, 329[7].
Cockerell, T. D. A., acknowledgments to, 19[6]; mentioned, 42[9], 46[2], 46[9], 63[4]; cited, 311[4].
coercens, Oxyethira, *see* Oxyethira coercens.
cognatella, Agraylea, 75[2].
Coleoptera, 11, 12[5], 13[5].
collata, Neotrichia, *see* Neotrichia collata.
Coloburus, 25[7], 28[2].
Compontia, 186[4].
  cruciformis, explanation of plate, 328[1].
Comstock, J. H., cited, 31[6], 79[9], 82[2], 86[2], 311[4]; acknowledgments to, 76[7].
concinnus, Procladius, 126[7], **129[8]–30[2]**.
confinis, Chironomus, 199[9], **248[2]**.
confusa, Ithytrichia, *see* Ithytrichia confusa.
congregata, Thalassomyia, *see* Thalassomyia congregata.
consimilis, Bombus, 13[4].
consimilis, Hydroptila, *see* Hydroptila consimilis.
consobrinus, Anatopynia, 135[7].
Coquillett, cited, 82[2], 145[6], 182[9], 257[6], 267[9], 268[4], 284[1], 307[4], 311[5].
Corethrinae, 81[8].
Corethrium pertinax, 77[8].
Corynocera, 90[3], 161[8]–62[5].
  crassipes, 162[4].
Corynoneura, 87[7], 90[6], 90[8], 93[3], 96[1], 116[8], 117[1], **162[9]–63[9]**.
  sp., explanation of plate, 329[6].
  atra, 164[1], 164[5].
  celeripes, **164[3]**; explanation of plate, 327[5].
Corynoneura lemnae, 88[6], 163[5]; explanation of plate, 329[5].
  scutellata, 163[9].
Cox, cited, 311[6].
Crane flies, 81[7].
crassicollis, Chironomus, 198[8], **245[9]**.
crassinervis, Tanypus, 156[6], **158[4]**.
crassipes, Corynocera, 162[4].
Cricotopus, 87[9], 88[9], 91[7], **250[8]–58[9]**, 259[1], 264[9], 265[1], 265[4], 273[5], 280[6]; key to species, 251[7]–52[6].
  bicinctus, 252[4], **256[3]**; explanation of plate, 326[5].
  debilis, 252[5], **258[6]**; explanation of plate, 326[5].
  exilis, 251[8], 251[0], 252[3], **255[2]–56[3]**, 256[9], 257[2], 257[4]; explanation of plates, 323[6], 326[5], 327[8].
  geminatus, 252[2], **253[3]**.
  sylvestris, 252[5], **257[8]–58[5]**; explanation of plate, 326[5].
  tremulus, 252[2], **252[7]–53[8]**.
  trifasciatus, 251[7], 251[9], 252[5], **253[7]–55[2]**; explanation of plates, 323[7], 326[4].
  var. tricinctus, 252[3].
  varipes, 251[8], 251[9], 252[4], **256[3]–57[7]**; explanation of plates, 324[8], 326[5].
cristata, Orthotrichia, 73[9], **75[6]**.
cristatus, Chironomus, *see* Chironomus cristatus.
cruciformis, Compontia, *see* Compontia cruciformis.
Crustaceans, 11, 13[1].
Culex, 83[4], 124[2].
Culicidae, 76[2].
Culicids, 81[8].
culiciformis, Tanypus, *see* Tanypus culiciformis.
Culicoides, 92[7], 98[9], 99[4], **101[3]**, 101[7], 111[5], 111[7], 111[9], 112[8].
  sp., explanation of plate, 320[1].
  murinus, 99[1].
  pulicaris, 101[5].
culicoides, Diamesa, *see* Diamesa culicoides.
cupidus, Blasturus, *see* Blasturus cupidus.
Curculionidae, 13[3].
Curtis, cited, 107[2], 244[9], 246[5], 311[7].

Cyanophyceae, 35[7], 40[8].
Cybister, 34[7].
Cyllene minutissimella, 65[3].
Cynigma, 23[9].

Dahl, cited, 311[7].
Damselflies, 7[6].
Darest, cited, 311[7].
debilipennis, Metriocnemus, 300[6], 302[5].
debilis, Cricotopus, *see* Cricotopus debilis.
Deby, cited, 118[6], 311[7].
decedens, ? Tanypus, 138[9], 156[9].
decorus, Chironomus, *see* Chironomus decorus.
deflectus, Tanytarsus, *see* Tanytarsus deflectus.
Degeer, cited, 123[3], 311[7].
delineatus, Hydroptila, *see* Hydroptila delineatus.
Derham, cited, 311[8].
devinctus, Chironomus, *see* Chironomus devinctus.
diabolica, Vespa, 13[5].
Diamesa, 88[8], 89[5], 90[2], 90[3], 93[7], 172[1], 172[3]–78[3], 183[3]; key to species, 174[1].
aberrata, 174[4], 174[5], 176[7], 176[9], 177[3].
chorea, 174[3], 176[9]–77[4].
culicoides, 174[2], 175[5], 177[4]–78[3]; explanation of plate, 329[3].
praecox, explanation of plate, 327[5].
waltlii, 88[1], 88[9], 174[1], 174[2], 174[8], 174[4]–76[8], 179[5], 274[4], 276[4]; explanation of plates, 321[3], 326[8], 327[2], 327[7].
dictyona, Climacia, 15[5].
Didymorphleps, 94[6], 99[5], 111[8]–12[8]; explanation of plate, 329[8].
hortorum, 112[8].
difficilis, Orthocladius, 266[9], 277[2].
Dilar, 16[5].
diminuta, Caenis, *see* Caenis diminuta.
Diptera, 7[7], 11, 12[6], 13[3]–14[1]; aquatic Nematocerous, 76–315.
discolor, Ablabesmyia, 138[3], 149[3].
dispar, Chironomus, 192[4], 213[7].
dissimilis, Tanytarsus, *see* Tanytarsus dissimilis.
diversus, Chironomus, 190[8].
dives, Tanytarsus, *see* Tanytarsus dives.
Diving beetle, 34[7].
Dixidae, 76[2].
dizonias, Chironomus, 256[4].
Doloplastus, 91[8], 171[5]; explanation of plate, 330[4].
dorsalis, Chironomus, *see* Chironomus dorsalis.
Douglass, cited, 282[3].
Dragonflies, 7[6], 14[5].
Drunella, 25[4], 27[6], 42[2], 42[4], 42[8]–43[4].
grandis, explanation of plate, 317[6], 317[7].
dualis, Oxyethira, *see* Oxyethira dualis.
Dufour, cited, 311[8].
Duisberg, cited, 78[2].
dux, Chironomus, *see* Chironomus dux.
Dyar, H. G., cited, 146[9], 190[4], 228[3], 235[3], 311[8].
dyari, Ablabesmyia, *see* Ablabesmyia dyari.

Eaton, cited, 18[4], 18[8], 21[1], 28[3], 28[8], 31[3], 31[7], 37[2], 38[4], 41[6], 42[9], 43[1], 47[1], 50[5], 51[7], 61[2], 63[3], 311[8].
Ecdyurus, 23[9], 26[8], 53[3].
maculipennis, 18[5], 35[9], 38[7], 52[4], 54[5], 57[1]; explanation of plates, 316[4], 316[9]; figures, 51, 52, 53; explanation of figures, 331[4], 331[5], 331[6], 331[7], 331[8].
Egger, cited, 311[9].
Elateridae, 13[6].
elegans, Chironomus, 299[5].
elegantula, Rhithrogena, *see* Rhithrogena elegantula.
Ellenberger, cited, 311[9].
Empids, 79[4].
Enallagma *sp.*, 14[7].
Enteromorpha, 116[8], 117[5].
Epeorus, 23[8].

Ephemera, 23[4], 26[6]; explanation of figure, 331[1]; venation of fore wing of, figure, 22.
varia, 18[2].
Ephemerella, 25[3], 27[5], 41[5]–42[3].
sp.?, 42[7], 46[2]–47[4]; explanation of plate, 317[7], 317[8].
sp.? near ignita, 45[6]–46[1].
bispina, 18[5], 42[5], 43[4]–45[1], 45[2], 45[5]; explanation of plate, 317[7], 317[8].
excrucians, 18[2], 41[7], 42[8], 46[3], 47[5]; explanation of plates, 317[4], 317[7].
grandis, 43[1], 43[3].
ignita, 41[7], 43[6], 45[7].
inermis, 46[9].
unicornis, 45[2].
walkeri, 43[6].
Ephemeridae, 11, 12[6], 15[2]; by J. G. Needham, 17[3]–62[9]; life history, 19[4]; structure, 19[7]–22[7]; classification, 28[7]–30[3].
Ephemerinae, 22[8], 26[4], 28[3], 29[6], 59[9]–62[9].
Eretmoptera, 89[3], 93[5], 113[6]–15[6]; explanation of plate, 329[1].
browni, 114[3]–15[6], 118[7].
Erickson, cited, 78[2].
Eristalis, 13[8].
Eurycnemus, 92[2], 199[6], 297[4], 297[9]–98[7]; key to species, 298[5].
sp., explanation of plate, 328[6].
aestivus, 299[2].
lasiomerus, 298[7], 299[4].
scitulus, 298[7], 298[8].
unicolor, 298[7], 299[1].
Eutanypus, 90[5], 93[3], 178[3]–79[7].
borealis, 178[6], 178[9]–79[5].
Euthyplocia, 23[3], 26[5].
exagitans, Metriocnemus, *see* Metriocnemus exagitans.
excrucians, Ephemerella, *see* Ephemerella excrucians.
exiguus, Tanytarsus, *see* Tanytarsus exiguus.
exilis, Cricotopus, *see* Cricotopus exilis.
Explanation of plates, 316[1]–30[9].
extremus, Camptocladius, 260[3], 264[3].
Fabricius, J. C., cited, 242[8], 311[9]–12[1].
Fabricius, O., cited, 311[9].
fallax, Chironomus, *see* Chironomus fallax.
fasciata, Ceratopogon, 104[7].
fasciata, Heteromyia, 109[4].
fasciatus, Ceratopogon, 107[3].
fasciatus, Tanypus, 159[2], 159[7].
fascipennis, Chironomus, 191[1], 203[2], 204[3].
fastuosa, Ablabesmyia, *see* Ablabesmyia fastuosa.
fatigans, Tanytarsus, *see* Tanytarsus fatigans.
femoralis, Hydroptila, 67[3].
femoratus, Ceratopogon, 105[2], 108[4].
femoratus, Melanoplus, 14[9]–15[1].
Ferguson, W. H., work of, 10[4].
ferruginea, Callibaetis, 18[5].
ferrugineovittatus, Chironomus, 197[5], 238[7]–39[2].
festivus, Chironomus, 196[3], 234[5], 242[1].
Figures, legenda to, 331[1].
fimbriatus, Chironomus, 198[6], 198[8], 245[2].
Fitch, cited, 275[5], 312[1].
flavellus, Tanytarsus, *see* Tanytarsus flavellus.
flaveola, Ablabesmyia, 138[4], 151[4], 152[1].
flavicinctus, Procladius, 126[5], 132[1].
flavicingula, Chironomus, *see* Chironomus flavicingula.
flavifrons, Ablabesmyia, *see* Ablabesmyia flavifrons.
flavifrons, Metriocnemus, *see* Metriocnemus flavifrons.
flavipennis, Heptagenia, 54[7].
flavipes, Ceratopogon, 106[6].
flavus, Chironomus, *see* Chironomus flavus
flavus, Orthocladius, *see* Orthocladius flavus.
Forbes, cited, 79[2], 312[1].
forcipatus, Anatopynia, 135[6].
Forcipomyia, 92[6], 100[8]–1[2].
bipunctata, 100[9].
nemoralis, 101[1].
nemorosus, 101[1].

Forcipomyia pictipennis, 100[9].
trichopterus, 100[9], 101[1].
Frauenfeld, cited, 312[2].
frauenfeldi, Thalassomyia, *see* Thalassomyia frauenfeldi.
frequens, Chironomus, *see* Chironomus frequens.
frici, Oxyethira, 71[3].
Fries, cited, 171[3], 312[2].
frigidus, Chironomus, 281[2].
frigidus, Orthocladius, 266[7], 267[5], 268[4].
fugax, Orthocladius, *see* Orthocladius fugax.
fulvescens, Tanytarsus, *see* Tanytarsus fulvescens.
fulviventris, Chironomus, *see* Chironomus fulviventris.
fulvus, Chironomus, *see* Chironomus fulvus.
fumidus, Chironomus, *see* Chironomus fumidus.
fumosus, Camptocladius, *see* Camptocladius fumosus.
furens, Oecacta, 102[3].
fusca, Tetraphora, 111[7].
fusca, Thalassomyia, *see* Thalassomyia fusca.
fuscipes, Metriocnemus, 301[2], 305[5]–6[1].
futilis, Ablabesmyia, 137[1], 139[7]–40[4].

Garman, H., cited, 79[1], 239[9], 250[2], 312[2].
Geinitz, cited, 77[5].
geminatus, Cricotopus, 252[2], 253[3].
Geoffroy, cited, 312[2].
Gercke, cited, 99[1], 312[2].
Gervais, cited, 312[3].
Giard, A., acknowledgments to, 9[1]; cited, 312[2].
Giebel, cited, 78[1].
Gimmerthal, cited, 312[3].
Girault, cited, 312[4].
glaucurus, Chironomus, 241[9].
gmundensis, Tanytarsus, *see* Tanytarsus gmundensis.
Goedart, cited, 312[4].
Goeze, cited, 312[1].
Gomphonema, 35[3].
graminicola, Camptocladius, 259[5], 260[3], 300[5].
grandaevum, Cecidomium, 77[8].
grandis, Chironomus, 237[2].
grandis, Drunella, *see* Drunella grandis.
grandis, Ephemerella, 43[1], 43[3].
Grasshoppers, 14[9].
grisea, Pentaneura, 161[2].
Grouse locust, 15[1].
Guerin, cited, 312[1].
guttularis, Ablabesmyia, 137[6], 145[5]–46[5].

Habrophlebia, 24[9], 27[4].
americana, 18[3].
Hagen, cited, 65[2], 312[5].
Halesus, 14[4].
Haliday, cited, 173[3], 312[5].
Halirytus, 89[4], 116[1]–17[2]; explanation of plate, 330[2].
amphibius, 116[3].
halteralis, Chironomus, *see* Chironomus halteralis.
hamata, Hydroptila, *see* Hydroptila hamata.
Hammond, cited, 78[6], 84[2], 86[8], 122[2], 124[1], 179[7], 181[1], 241[2], 244[7], 312[5], 313[9].
Hart, C. A., mentioned, 29[8]; cited, 312[5].
Heeger, cited, 173[1], 177[3], 312[5].
Hemerobiidae, 15[6]–17[3]; key to genera, 16[4]–17[3].
Hemerobius, 17[3].
amiculus, 15[5], 16[1].
occidentalis, 16[2].
tutatrix, explanation of plate, 316[3].
Hemiptera, 11, 12[5], 14[9].
Henshaw, S., cited, 129[3], 129[8], 130[6], 131[5], 132[4], 154[9]; acknowledgments to, 153[2].
Heptagenia, 24[1], 26[7], 32[4].
sp. ?, explanation of plate, 317[5].
sp., no. 3, 56[2].
flavipennis, 54[7].
interpunctata, 18[5], 54[3]–56[1], 57[1]; explanation of plates, 316[5], 317[5]; figures, 52, 53; explanation of figures, 331[5], 331[6], 331[7].
pulchella, 18[1].

Heptageninae, 23[7], 26[7], 29[5], **51[5]–54[4]**; figure, 52; explanation of figure, 331[5], 331[6], 331[7].
Heptagyia, 90[1], 121[9], 161[5]; explanation of plate, 330[7].
Heteromyia, 93[3], 99[5], **108[8]**; explanation of plate, 330[3].
fasciata, 109[4].
heterostropha, Physa, 12[7].
Hexagenia, 23[5], 26[6].
variabilis, 18[2].
Heyden, cited, 78[4].
hilaris, Caenis, *see* Caenis hilaris.
hilaris, Chironomus, 199[4], **247[4]**.
hippocastanum, Aesculus, 98[7].
hirtipennis, Ablabesmyia, 138[8], **154[6]**.
hirtipes, Chironomus, 299[5].
Holmgren, cited, 264[7], 268[9], 276[7], 282[4], 283[3], 305[3], 312[6].
Homeoneuria, 29[6].
hortorum, Didymorphleps, 112[6].
hortulanus, Ceratopogon, 106[6].
Houghton, C. O., acknowledgments to, 76[8]; cited, 302[4], 313[6].
Howard, W. E., cited, 18[5], 263[8], 312[6]; mentioned, 59[6]; Polymitarcys albus, 60[2]–62[9].
Howdy, white-gloved, 31[5]–36[2].
humeralis, Procladius, 126[7], 130[2].
humeralis, Tanypus, 135[7].
Hydrobaenus, 87[5], 88[6], 91[2], 166[3], **170[5]–71[4]**.
lugubris, 170[6]; explanation of plate, 328[2].
Hydropsyche, 14[4], 32[1], 32[2].
Hydroptila, 63[7], 65[1], 65[4]–69[5], 72[9].
sp., 73[3].
consimilis, 65[5], **65[7] 66[2]**, 66[7]; explanation of plates, 318[4], 319[3].
delineatus, **66[2]**; explanation of plate, 318[4].
femoralis, 67[3].
hamata, **67[1]**; explanation of plate, 318[6].
perdita, **67[4]**; explanation of plate, 319[1].
sparsa, 65[6], 66[1].
spatulata, **66[7]**; explanation of plate, 318[5].
Hydroptilidae, 8[2], 63[1]–72[9], 73[2].
Hydrotrechus, *sp.*?, 14[9].
Hymeneptera, 11, 12[5], 13[2].
hyperboreus, Chironomus, *see* Chironomus hyperboreus.

ignita, Ephemerella, 41[7], 43[6], 45[7].
ignotus, Chirotenetes, 28[9].
Imms, cited, 312[7].
incomptus, Metriocnemus, 300[5], **304[1]**
indecisa, Ablabesmyia, *see* Ablabesmyia indecisa.
inermis, Ephemerella, 46[9].
innocuus, Chironomus, 196[3], **235[5]–36[2]**.
Insecta lapponica, 161[9].
insipidus, Micromus, *see* Micromus insipidus.
intermedius, Chironomus, 244[4].
interpunctata, Heptagenia, *see* Heptagenia interpunctata.
Iron, 23[8], 26[9], 53[3], 54[1].
sp.?, **57[8]–59[2]**; explanation of plate, 317[1]; figures, 52, 53; explanation of figures, 331[5], 331[6], 331[7].
isemerius, Scopelodromus, 308[5].
Isoplastus, 89[8], 121[9], 125[5], 125[7], **155[6]**; explanation of plate, 330[5].
Ithytrichia, 64[5], 67[6]–69[6].
clavata, **67[8]–69[2]**; explanation of plates, 318[7], 319[2].
confusa, **69[2]**; explanation of plate, 318[7].
lamellaris, 68[6].

Jacobs, cited, 312[7].
Jaworowski, cited, 312[7].
Joblot, cited, 312[7].
Johannsen, Oskar Augustus, Aquatic Nematoceras Diptera, 7[3], 76–315; cited, 312[8].
Johnson, cited, 216[1], 218[6], 222[9], 223[4], 228[4], 231[6], 232[7], 232[8], 243[2], 258[5], 262[8], 268[4], 312[8].
johnsoni, Ablabesmyia, 137[8], **147[9]–48[4]**.
Jolia, 28[8].
roeseli, 28[9].
jonas, Micromus, *see* Micromus jonas.

jucundus, Chironomus, 195[8], 198[9], 232[8].
Juday, Chauncey, acknowledgments to, 19[7]; mentioned, 43[3], 59[3].
Julus, 12[4].
junci, Tanytarsus, 286[3], **290[9]–91[5]**.
junius, Anax, 14[7].

Kellogg, V. L., acknowledgments to, 76[6]; cited, 78[8], 84[2], 113[7], 114[2], 312[8].
Kennicott, R., mentioned, 238[6].
Kertesz, cited, 312[9].
Kerville, cited, 312[9].
kervilli, Orthocladius, *see* Orthocladius kervilli.
Keys, use of, 19[8]; to species of Ablabesmyia, 136[1]–38[8]; to species of Camptocladius, 259[5]–60[8]; to species of Chasmatonotus, 166[4]; to genera of Chironomidae, 87[1]–94[5]; to species of Chironomus, 188[3]–99[9]; to species of Cricotopus, 251[7]–52[6]; to species of Diamesa, 174[1]; to species of Eurycnemus, 298[5]; to genera of Hemerobiidae, 16[4]–17[3]; to genera of Mayflies of North America, 22[8]–28[2]; to species of Metriocnemus, 300[2]–1[2]; to species of Orthocladius, 265[4]–67[7]; to species of Procladius, 126[2]–27[3]; to species of Tanypus, 156[7]; to species of Tanytarsus, 285[1]–86[7]; to species of Thalassomyia, 183[3].
Kieffer, Abbe J.J., cited, 92[2], 93[3], 94[5], 101[2], 105[2], 106[3], 106[6], 108[5], 120[3], 163[4], 164[5], 258[9], 312[9], 313[1], 313[3].
Kienitz, cited, 313[2].
Kirby, cited, 313[2].
Klapálek, cited, 64[8].
Knab, Fred, mentioned, 307[2].
knabi, Metriocnemus, *see* Metriocnemus knabi.
Kollar, cited, 313[2].
Köllicker, cited, 313[2].
Kupfer, cited, 313[2].

Labidomyia, 100[9], 101[1].
Laboulbene, cited, 313[3].
lactipennis, Anatopynia, 135[7].
lamellaris, Ithytrichia, 68[6].
lapponica, Insecta, 161[9].
lasiomerus, Chironomus, 199[6].
lasiomerus, Eurycnemus, 298[7], **299[3]**.
lasiopus, Chironomus, 199[1], 199[5], **247[2]**.
Latreille, cited, 313[3].
Lauterborn, R., acknowledgments to, 9[1].
Leger, cited, 313[3].
lemnae, Corynoneura, *see* Corynoneura lemnae.
Lepidoptera, 11, 12[6], 15[2].
Leptoconops, 92[4], 94[3], **94[7]**, 96[2]; explanation of plate, 328[9].
Leptophlebia, 24[8], 27[3], 50[5].
praepedita, 18[5], **49[8]–51[5]**; explanation of plate, 317[6].
Leptophyes, 49[7].
Lestes, *sp.*, 14[7].
Levi-Morenos, cited, 313[4].
Limnophyes, 90[7], **165[2]–66[2]**; explanation of plate, 330[2].
pusillus, 166[2].
lineatus, Chironomus, 194[1], 196[2], **223[1]**.
lineola, Chironomus, 196[2], 223[2], **234[8]**.
Linne, cited, 313[4].
Lintner, cited, 313[4].
littoralis, Tipula, 218[5].
lobifer, Chironomus, 233[5].
lobiferus, Chironomus, *see* Chironomus lobiferus.
Loew, cited, 78[1], 103[5], 108[3], 313[5].
Long, W. H., cited, 100[8], 313[5].
longimanus, Chironomus, *see* Chironomus longimanus.
longipes, Chironomus, 222[5].
Lowne, cited, 84[6].
lucidus, Polycentropus, 14[4].
ludens, Ameletus, *see* Ameletus ludens.
lugubris, Chironomus, 193[6], **221[7]**.
lugubris, Hydrobaenus, *see* Hydrobaenus lugubris.
Lundbeck, cited, 139[1], 153[7], 164[5], 207[3], 207[5], 227[3], 245[1], 246[5], 260[7], 260[8], 262[3], 262[5], 263[7], 264[3], 264[8], 268[9], 276[7], 277[2], 277[6], 278[7], 279[2], 281[6], 291[5], 296[3], 301[5], 302[8], 303[4], 304[3], 305[9], 313[6].
lundbeckii, Metriocnemus, *see* Metriocnemus lundbeckii.
Lyonet, cited, 313[6].

MacGillivray, A. D., acknowledgments to, 76[8]; mentioned, 105[4], cited, 302[4], 313[6].
McLachlan, R., mentioned, 63[4]; cited, 63[8], 64[4], 64[7], 65[3], 69[9], 74[2], 75[2].
Macquart, cited, 313[7].
Macropeza, 77[7], 92[8], **169[8]–70[4]**; explanation of plate, 328[7].
Macroptilum, **308[8]**.
  nudum, 308[9].
maculata, Calopteryx, 14[6].
maculatus, Chasmatonotus, 167[3].
maculatus, Tipula, 142[3].
maculipennis, Ecdyurus, *see* Ecdyurus maculipennis.
magellanica, Belgica, 113[6].
marinus, Clunio, *see* Clunio marinus.
Martin, J. O., mentioned, 47[5].
Mayer, cited, 84[4], 313[7].
Mayflies of North America, key to genera, 22[3]–28[2]. *See also* Ephemeridae.
Megerle, cited, 106[1].
Meigen, cited, 105[9], 106[1], 125[6], 155[5], 306[1], 313[7].
Meinert, cited, 124[3], 313[8].
Melander, A. L., acknowledgments to, 76[8].
Melanoplus femoratus, 14[5]–15[1].
melanops, Ablabesmyia, *see* Ablabesmyia melanops.
Metriocnemus, 87[5], 88[8], 92[2], 93[4], 162[8], 172[2], 260[8], **299[6]–307[3]**; key to species, 300[2]–1[2].
  atratulus, 300[9], **304[4]**; explanation of plates, 327[3], 327[9].
  debilipennis, 300[6], **302[5]**.
  exagitans, 300[7], **303[7]**; explanation of plate, 327[2].
  flavifrons, 300[8], 300[8], **301[5]**; explanation of plate, 327[1].
  fuscipes, 301[2], **305[5]–6[1]**.
  incomptus, 300[8], **304[1]**.
  knabi, 300[9], **306[2]–7[4]**; figures, 306; explanation of figures, 331[9].
  lundbeckii, 300[6], 301[5], **302[9]–3[6]**; explanation of plate, 327[1].
  modestus, 304[4].
  nanus, 300[3], **301[3]**, 303[5].
Metriocnemus par, 300[4], **301[9]–2[4]**; explanation of plates, 327[1], 327[9].
  picipes, 306[1].
  ursinus, 301[2], **304[3]–5[5]**.
Miall, cited, 78[6], 84[2], 86[8], 124[1], 179[7], 181[1], 186[3], 241[2], 313[9].
Micromus, 16[7].
  sp., 15[5].
  angulatus, 15[6].
  insipidus, explanation of plate, 316[3].
  jonas, **15[6]–16[4]**; explanation of plate, 316[8].
Midge, net-winged, 54[2], 59[1].
Mik, cited, 96[1], 98[6], 313[9]–14[1].
Miller, Mrs Mary Rogers, acknowledgments to, 19[7]; mentioned, 49[5].
Millipedes, 11.
minimus, Camptocladius, *see* Camptocladius minimus.
minutissimella, Cyllene, 65[3].
minutus, Orthocladius, *see* Orthocladius minutus.
modestus, Chironomus, *see* Chironomus modestus.
modestus, Metriocnemus, 304[4].
Molanna cinerea, 14[4].
monilis, Ablabesmyia, *see* Ablabesmyia monilis.
monilis, Tanypus, 144[6].
Monnier, cited, 314[1].
morio, Anatopynia, 135[7].
Morley, cited, 314[1].
Morton, Kenneth J., North American Hydroptilidae, 63[1]–72[9].
Mosquitos, 81[7].
Mueller, O. T., cited, 314[2].
multipunctata, Agraylea, *see* Agraylea multipunctata.
murinus, Culicoides, 99[1].
muticus, Tanytarsus, *see* Tanytarsus muticus.

nanus, Chironomus, 302[9].
nanus, Metriocnemus, 300[3], **301[3]**, 303[5].
nebulosus, Tanypus, 139[1].
Needham, James G., bulletin on stoneflies (Perlidae), 8[6]; The Summer Food of the Bullfrog (Rana

catesbiana Shaw) at Saranac Inn, 9²–15⁵; Ephemeridae, 17³–62⁹; cited, 68⁹, 71⁶, 78⁹, 79⁶, 79⁸, 86², 311¹, 314²; mentioned, 74¹, 75⁸, 105⁴, 107⁴, 167³; acknowledgments to, 76⁸.
nemoralis, Forcipomyia, 101¹.
nemorosus, Forcipomyia, 101¹.
Neotrichia, 65², 72².
collata, 72⁵; explanation of plate, 318⁹, 319¹.
nervosus, Procladius, *see* Procladius nervosus.
nervosus, Tanypus, 134¹.
Neuronia postica, 14².
Neuroptera, 11, 12⁶, 15⁴.
nigricans, Chironomus, *see* Chironomus nigricans.
nigripilus, Tanytarsus, 285⁵, 287³.
nigritibia, Chironomus, 198⁶, 246¹.
nigropunctata, Ablabesmyia, 138³, 151², 155¹.
nitidellus, Chironomus, 191⁹, 210⁶.
niveipennis, Chironomus, 191⁶, 205⁹–7⁴.
niveipes, Chironomus, 217⁵.
nivoriundus, Chironomus, 176⁵.
nivoriundus, Orthocladius, *see* Orthocladius nivoriundus.
Nowicki, cited, 314².
nubeculosus, Chironomus, 190³.
nudipes, Anatopynia, 135⁶.
nudum, Macroptilum, 308⁹.

obediens, Tanytarsus, *see* Tanytarsus obediens.
obesa, Baetisca, *see* Baetisca obesa.
obscura, Thalassomyia, 182⁸, 183⁹, 184¹–85⁵.
obscurus, Chironomus, 206², 283⁴.
obumbratus, Orthocladius, *see* Orthocladius obumbratus.
occidentalis, Hemerobius, 16².
occidentalis, Procladius, 126⁴, 127⁵.
occidentalis, Spadobius, *see* Spadobius occidentalis.
oceanicus, Chironomus, 199³.
oceanicus, Orthocladius, *see* Orthocladius oceanicus.
octopunctatus, Chironomus, 190⁵, 201⁵.
Odonata, 11, 12⁶, 14⁵.
Odonata-Anisoptera, 7⁶.
Odonata-Zygoptera, 7⁶.
Occacta, 92⁸, 94², 99⁵, 101⁶–2³.
furens, 102³.
Oligoneuria, 29³, 29⁶.
ornata, Ablabesmyia, 137⁸, 148⁴.
ornata, Ceratopogon, 102⁷.
Orthocladius, 87⁵, 88⁹, 91⁹, 162⁵, 171⁵, 172³, 172⁹, 183⁴, 183⁵, 185⁹, 249⁴, 251², 258⁶, 258⁸, 264⁸–84¹, 306⁶; key to species, 265⁴–67⁷.
absurdus, 267¹, 277⁷–78²; explanation of plates, 326⁷, 327², 327⁹.
atomarius, 266⁷, 276⁸–77².
barbicornis, 266⁶, 283³.
basalis, 267⁷, 282³.
claripennis, 267², 278⁵.
clepsydrus, 266⁵, 283⁸–84¹.
difficilis, 266⁹, 277².
flavus, 265⁵, 265⁷, 266⁴, 270⁴–72¹; explanation of plates, 323⁸, 326⁷.
frigidus, 266³, 267⁵, 268⁴.
fugax, 257², 265⁵, 265⁸, 267³, 279²–80⁹; explanation of plates, 324³, 326⁷.
kervilli, explanation of plate, 327⁵.
minutus, 267², 267³, 278⁴, 278⁸–79².
nivoriundus, 265⁶, 265⁷, 266⁶, 274³–76⁴; explanation of plates, 324¹, 326⁷.
obumbratus, 267⁶, 281⁶–82³; explanation of plate, 326⁸.
oceanicus, 266³, 269¹–70⁴; explanation of plate, 328⁵.
par, 265⁹, 267⁷, 302⁴.
platypus, 182⁹–83¹, 267⁴.
politus, 266², 268¹.
pubitarsis, 267⁶, 268⁹, 281¹, 282².
sordens, 266⁴, 272²; explanation of plate, 326⁷.
sordidellus, 265⁶, 265⁸, 266⁴, 266⁸, 267⁵, 272⁵–74², 276⁹; explanation of plates, 324⁵, 326⁷.
stercorarius, 266⁶, 275⁵, 276⁴, 300⁹, 304⁵.
variabilis, 273⁷.
Orthoptera, 11, 12⁶, 14⁹–15².

Orthotrichia, 64[9], 69[6]–70[7].
americana, 73[9], 75[6]; figure, 73; explanation of figure, 331[3].
angustella, 69[7], 70[1], 70[3], 70[5].
brachiata, 70[2]; explanation of plate, 318[3].
cristata, 73[9], 75[6].
tetensii, 69[9], 75[9].
Osborn, cited, 249[2], 314[2].
Osten Sacken, cited, 160[3], 238[6], 244[7], 314[3].
Oxyethira, 64[9], 70[7]–72[1], 72[3].
coercens, 70[9]–71[3]; explanation of plate, 318[3].
dualis, 71[7]–72[1]; explanation of plate, 319[3].
frici, 71[3].
viminalis, 71[3]; explanation of plate, 318[9].

Pachyleptus, 108[8], 109[4], 110[1].
Packard, A. S., cited, 110[3], 270[8], 314[3].
pallens, Ablabesmyia, *see* Ablabesmyia pallens.
pallens, Chironomus, 212[3], 213[2].
palliatus, Chironomus, 192[3], 193[7], 217[9]–18[3].
pallidus, Chironomus, *see* Chironomus pallidus.
Palmobius, 17[1].
amiculus, explanation of plate, 316[3].
Palpomyia, 93[1], 93[9], 99[4], 104[8], 105[2], 105[9]–6[4], 106[3].
Panger, cited, 314[4].
par, Metriocnemus, *see* Metriocnemus par.
par, Orthocladius, 265[9], 267[7], 302[4].
parvus, Camptocladius, 260[2], 263[8].
pavidus, Chironomus, 282[4].
pectinata, Psamathiomyia, *see* Psamathiomyia pectinata.
pedellus, Chironomus, *see* Chironomus pedellus.
pedestris, Chironomus, 193[1], 219[1].
Pedicia albivitta, 8[2].
pellucidus, Chironomus, 199[9], 248[5].
pennsylvanicus, Camponotus, 13[3].
Pentagenia, 26[6].
Pentaneura, 89[9], 121[9], 160[3]–61[2]; explanation of plate, 330[5].
grisea, 161[2].
perdita, Hydroptila, *see* Hydroptila perdita.
Perlidae, 8[6].
Perris, cited, 314[4].
pertinax, Corethrium, 77[8].
Pettit, cited, 314[4].
Philippi, cited, 314[5].
photophila, Burmeisteria, 172[7].
Physa heterostropha, 12[7].
picipes, Metriocnemus, 306[1].
pictipennis, Ablabesmyia, *see* Ablabesmyia pictipennis.
pictipennis, Forcipomyia, 100[9].
pictipennis, Psychophaena, 111[5].
pilicornis, Chironomus, 206[2].
pilipes, Chironomus, 244[5].
pilosella, Ablabesmyia, 138[4], 138[6], 152[8]–53[3].
pinguis, Procladius, *see* Procladius pinguis.
Plant-beetles, aquatic, 7[7].
Plates, explanation of, 316[1]–30[9].
platypus, Orthocladius, 182[9]–83[1], 267[4].
platypus, Thalassomyia, 183[9], 185[5]–86[1].
plumipes, Tanypus, 135[6].
plumosus, Chironomus, *see* Chironomus plumosus.
Podonomus, 89[9], 121[9], 161[2]; explanation of plate, 330[4].
stigmaticus, 161[4].
Poey, cited, 314[5].
polaris, Chironomus, 198[4], 206[9], 244[3]–45[3].
politus, Orthocladius, 266[2], 268[1].
Polycentropus lucidus, 14[4].
Polymitarcys, 23[1], 26[5].
albus, 18[8], 59[9], 60[2]–62[9]; explanation of plate, 318[2].
virgo, 29[2], 60[1].
Polystoechotes, 16[6].
postica, Neuronia, 14[2].
posticalis, Tanypus, *see* Tanypus posticalis.
Potamanthus, 23[6], 26[6].
praecox, Diamesa, *see* Diamesa praecox.

praepedita, Leptophlebia, *see* Leptophlebia praepedita.
prasinus, Chironomus, *see* Chironomus prasinus.
Prionomyia, 108[3], 108[4].
priscus, Rhyphus, 77[9].
Procladius, 89[7], 121[9], 125[5], 125[7], 125[3]–27[3]; key to species, 126[2]–27[3]; explanation of plate, 330[4].
adumbratus, 126[2], 127[1], 132[5]–33[5], 136[3], 136[5]; explanation of plates, 320[7], 321[1].
bellus, 126[5], 128[5], 128[7]–29[3].
caliginosus, 126[9], 131[5]; explanation of plate, 325[4].
concinnus, 126[7], 129[3]–30[2].
flavicinctus, 126[3], 132[1].
humeralis, 126[7], 130[2].
nervosus, 158[6], 158[8], 160[2]; explanation of plate, 330[8].
occidentalis, 126[4], 127[3].
pinguis, 126[2], 127[2], 131[6], 133[3]–34[5], 136[6]; explanation of plates, 320[5], 325[4].
pusillus, 126[5], 128[1]; explanation of plate, 325[4].
scapularis, 127[2], 134[5]–35[4]; explanation of plate, 325[4].
thoracicus, 126[6], 129[3].
tricolor, 126[3], 130[9]–31[5].
turpis, 126[4]. *See also* Tanypus (Procladius) turpis.
Prodromus, 106[5].
Prosopistoma, 29[7].
Psamathiomyia, 87[2], 89[4], 113[7], 117[3]–20[1].
pectinata, 117[4]; explanation of plate, 328[3].
Psychophaena, 94[6], 99[5], 111[2].
pictipennis, 111[5].
pubitarsis, Orthocladius, *see* Orthocladius pubitarsus.
pubitarsus, Tanypus, 135[7].
pulchella, Heptagenia, 18[1].
pulchripennis, Ablabesmyia, *see* Ablabesmyia pulchripennis.
pulchripennis, Chironomus, 191[8], 203[5], 204[4].
pulicaris, Culicoides, 101[5].
pumilio, Camptocladius, 259[9], 261[7]–62[3].
punctata, Ceratopogon, 101[5].
punctipennis, Tanypus, 125[6], 155[9].
Punkies, 77[4].
pusillus, Limnophyes, 166[2].
pusillus, Procladius, *see* Procladius pusillus.
pusio, Tanytarsus, 286[3], 291[5].
pygmaea, Baetis, 18[1], 40[4].

Rana catesbiana, 8[5]; summer food of, at Saranac Inn, by J. G. Needham, 9[2]–15[5]; explanation of plate, 316[1].
Reaumur, cited, 238[5], 314[5].
redeuns, Chironomus, 197[3], 236[6].
Rhithrogena, 24[1], 27[2], 53[3], 53[7], 54[1].
elegantula, 59[2]; explanation of plate, 317[1]; figures, 52. 53; explanation of figures, 331[5], 331[6]. 331[7], 331[8].
Rhyphus priscus, 77[9].
Richardson, R. E., mentioned, 309[1].
Ridley, cited, 314[5].
Riley, C. V., acknowledgments to, 76[8]; cited, 238[6], 314[5].
riparius, Chironomus, *see* Chironomus riparius.
Ris, cited, 64[3].
roeseli, Jolia, 28[9].
Rondani, cited, 314[5].
rondani, Alasion, 106[4].
rostratus, Ceratopogon, 112[7].
rudis, Chironomus, 206[2].

St Pauli, Telmatogeton, *see* Telmatogeton St Pauli.
Sandflies, 77[4].
Say, cited, 109[5], 109[8], 144[7], 224[2], 228[4], 253[6], 314[6].
scalaenus, Chironomus, *see* Chironomus scalaenus.
scapularis, Procladius, *see* Procladius scapularis.
Scarabaeidae, 13[6].
Schiner, cited, 160[3], 162[4], 168[2], 211[9], 214[3], 238[5], 253[3], 283[7], 296[8], 304[7], 305[9], 314[7].
Scholtz, cited, 314[7].

Schrank, cited, 314[7].
Schubaert, cited, 314[8].
scirpi, Wulpiella, *see* Wulpiella scirpi.
scitulus, Eurycnemus, 298[7], 298[8].
Scopelodromus, 91[6], 307[4]–8[7].
  isemerius, 308[5].
Scudder, cited, 78[5], 314[8].
scutellata, Corynoneura, 163[9].
Sendelia, 78[2].
Serromyia, 93[3], 99[5], 106[7], 108[3].
setulosa, Bezzia, *see* Bezzia setulosa.
Sialididae, American, 7[7].
Silfvenius, A. J., cited, 74[2].
similis, Chironomus, *see* Chironomus similis.
Simuliidae, 76[2].
Simulium, 32[2].
Siphlurus, 25[8], 27[8]; figure, 20; explanation of figure, 331[1].
  alternatus, 15[2], 18[2], 19[2].
Sisyra, 16[6].
  umbrata, 15[4].
skokiana, Callibaetis, 18[3], 40[6].
Skuse, cited, 106[2], 108[5], 125[5], 125[7], 135[9], 155[9], 314[5].
Slater, cited, 314[8].
Slosson, cited, 245[6], 314[9].
Smith, cited, 314[9].
Smittia, 91[4], 171[7]–72[3].
  brevipennis, 172[1].
Snails, 11.
sordens, Orthocladius, *see* Orthocladius sordens.
sordidellus, Orthocladius, *see* Orthocladius sordidellus.
Spadobius, 16[9].
  occidentalis, explanation of plate, 316[2].
Spaniotoma, 90[5], 162[5]; explanation of plate, 330[5].
  bivittata, 162[8].
sparsa, Hydroptila, 65[6], 66[1].
spatulata, Hydroptila, *see* Hydroptila spatulata.
Sphaeromas, 93[2], 99[5], 107[1]; explanation of plate, 319[8].
  argentata, *see* Ceratopogon (Sphaeromas) argentata.
  argentatus, 107[4]–8[3]; explanation of plates, 320[3], 327[3].
Spiders, 11.
spilopterus, Chironomus *see* Chironomus spilopterus.
Stactobia, 65[1].
Staeger, cited, 139[1], 153[7], 207[3], 261[7], 262[8], 268[9], 283[2], 306[1], 314[9].
staegeri, Chironomus, *see* Chironomus staegeri.
stellatus, Tanypus, *see* Tanypus stellatus.
Stenoxenidae, 81[9].
Stenoxenus, explanation of plate, 329[4].
Stephens, cited, 105[9], 314[9].
stercorarius, Orthocladius, *see* Orthocladius stercorarius.
stigmaterus, Chironomus, 197[7], 241[8]–42[1].
stigmaticus, Podonomus, 161[4].
Stoneflies, 8[6].
Stratiomyia badius?, 13[9].
Stratiomyidae, 13[7].
Swainson, cited, 186[2], 315[1].
sylvaticus, Tanypus, 159[8].
sylvaticus, Tanytarsus, 287[3].
sylvestris, Cricotopus, *see* Cricotopus sylvestris.
Syrphidae, 13[7].

Tabanidae, 13[7].
Tachinidae, 13[7].
taeniapennis, Chironomus, *see* Chironomus taeniapennis.
taenionotus, Chironomus, 194[8], 223[9]–24[2].
Tanypus (group), 121[9]–79[6], 87[3], 88[3], 89[6], 93[6].
Tanypus (genus), 78[1], 80[4], 83[3], 83[4], 89[8], 121[9], 140[4], 142[3], 142[5], 149[1], 149[3], 149[8], 151[4], 151[6], 153[3], 155[8]–60[8], 178[4], 306[9]; key to species, 156[1].
  sens. str., 125[5].
  sp., 110[9]; explanation of plate, 327[3].
  annulatus, 142[9], 144[6], 144[7], 156[9].
  annulipes, 161[8].
  baltimoreus, 156[3], 160[5].
  bellus, 128[3].

Tanypus bicolor, 149[9].
choreus, 156[7], **159[6]–60[2]**.
cinctus, 125[6], 155[9].
crassinervis, 156[6], **158[4]**.
culiciformis, 156[4], 156[7], **158[9]–59[6]**, 160[7]; explanation of plates, 325[6], 327[3].
decedens, 138[9], 156[9].
fasciatus, 159[2], 159[7].
monilis, 144[9].
nebulosus, 139[1].
nervosus, 134[1].
plumipes, 135[6].
posticalis, 156[8], **157[9]–58[3]**; explanation of plate, 330[7].
punctipennis, 125[6], 155[9].
stellatus, 156[3], **157[1]**; explanation of plate, 325[5].
sylvaticus, 159[3].
tenuis, 159[2].
tibialis, 156[8], **160[3]**.
tricolor, 135[7].
(Procladius?) turpis, **127[8]**, 135[7].
varius, 124[4].
Tanytarsus, 87[7], 88[2], 91[9], **284[2]–97[8]**; key to species, 285[1]–86[7].
sp., 286[2], **290[4]**, **297[3]**; explanation of plates, 322[5], 322[6].
deflectus, 285[9], 286[2], **288[1]**; explanation of plates, 322[2], 326[3].
dissimilis, 285[3], 285[6], 286[4], 286[6], **292[4]–93[3]**; explanation of plates, 324[6], 327[3].
var. a, 285[6].
dives, 285[2], 285[5], 286[2], **288[5]–90[4]**; explanation of plates, 324[9]–25[1], 326[9], 327[9].
exiguus, 226[8], 285[3], 285[4], 286[7], 293[2], 293[5], **294[7]–96[5]**; explanation of plates, 325[2], 327[9].
fatigans, 286[4], **292[1]**; explanation of plate, 326[9].
flavellus, 286[7], **296[9]–97[8]**; explanation of plate, 326[9].
fulvescens, 286[5], **293[9]–94[3]**; explanation of plate, 326[9].
gmundensis, 285[2], 285[9], **287[7]**; explanation of plate, 326[3].
Tanytarsus junci, 286[3], **290[6]–91[5]**.
muticus, 286[6], **294[1]**; explanation of plate, 326[9].
nigripilus, 285[8], **287[3]**.
obediens, 285[8], 286[8]–87[3]; explanation of plate, 326[3].
pusio, 286[3], **291[5]**.
sylvaticus, 287[3].
tenuis, 286[6], **296[6]**.
Taylor, cited, 273[5], 315[1].
Telmatogeton, 88[7], 90[9], 93[4], 94[1], **168[1]–69[1]**.
alaskensis, 169[1], **169[2]**.
St Pauli, 168[2], 168[9]; explanation of plate, 328[9].
tendens, Chironomus, *see* Chironomus tendens.
tenellus, Chironomus, *see* Chironomus tenellus.
tentans, Chironomus, *see* Chironomus tentans.
tenuis, Tanypus, 159[2].
tenuis, Tanytarsus, 286[6], **296[6]**.
ternarius, Bombus, 13[4].
Ternipus, 160[5].
Tersesthes, 92[4], 94[3], **95[1]–96[4]**.
torrens, **96[4]**; explanation of plate, 328[9].
tetensii, Orthotrichia, 69[9], 75[9].
Tetragoneuria, 12[6], 14[8].
Tetraphora, 94[6], 99[5], **111[5]**; explanation of plate, 330[8].
fusca, **111[7]**.
Text figures, legenda to, 331[1].
Thalassomyia, 88[3], 91[6], **182[3]–86[4]**, 307[3]; key to species, 183[9].
congregata, 88[9], 182[9], 183[1], 308[5].
frauenfeldi, 182[9], **186[2]**, 308[6]; explanation of plate, 328[1].
fusca, 88[2], 174[5], 225[3], 271[8], 308[5]; explanation of plate, 326[3].
obscura, 182[9], 183[9], **184[1]–85[8]**.
platypus, 183[8], **185[3]–86[1]**.
Theobald, cited, 186[4], 315[2].
thoracicus, Procladius, 126[6], **129[3]**.
tibialis, Ablabesmyia, *see* Ablabesmyia tibialis.
tibialis, Tanypus, 156[3], **160[3]**.

Tipula, 142[2], 158[9], 201[3], 212[2], 218[4], 222[5], 252[3], 257[8], 262[4], 276[4], 283[6].
arundineti, 149[8].
cantans, 218[5].
littoralis, 218[5].
maculatus, 142[2].
? virens, 230[6].
Tipulid larva, 8[5].
Tipulidae, 13[7].
Tipulids, 81[7].
Tömösvary, cited, 182[9], 315[2].
torrens, Tersesthes, *see* Tersesthes torrens.
Tortricids, 178[1].
Townsend, cited, 101[9], 102[1], 315[2].
Treat, cited, 315[2].
tremulus, Cricotopus, 252[2], **252**[7] 53[5].
triannulatus, Chironomus, 258[1].
trichomerus, Chironomus, 199[6], **248**[6].
Trichoptera, 8[2], 11, 12[5], 14[2].
trichopterus, Forcipomyia, 100[6], 101[1].
tricinctus, Chironomus, 253[7].
tricolor, Procladius, 126[6], **130**[9]–**31**[5].
tricolor, Tanypus, 135[7].
Tricorythus, 49[7].
trifasciatus, Cricotopus, *see* Cricotopus trifasciatus.
tristis, Chironomus, 213[2].
Tubipex, 123[9].
turpis, Procladius, 126[4].
turpis, Tanypus (Procladius), 127[7], 135[7].
tutatrix, Hemerobius, *see* Hemerobius tutatrix.

Ulmer, cited, 69[2], 295[1], 315[3].
umbrata, Sisyra, 15[4].
unicolor, Chironomus, 199[7].
unicolor, Eurycnemus, 298[7], **299**[1].
unicornis, Ephemerella, **45**[2].
unimaculatus, Chasmatonotus, 166[7], 167[1], **167**[6].
univittatus, Chasmatonotus, 166[9], **167**[4].
ursinus, Metriocnemus, 301[2], **304**[8]–5[5].

Van der Wulp, cited, 140[4], 170[4], 182[7], 187[2], 212[1], 216[6], 216[7], 218[9], 227[3], 232[7], 244[2], 244[6], 255[2], 256[6], 261[7], 262[8], 297[3], 298[5], 300[2], 304[4], 305[9], 315[3].
Van Duzee, E. P., mentioned, 30[5].
Vaney, cited, 315[4].
varia, Ephemera, 18[2].
variabilis, Chironomus, 272[6].
variabilis, Hexagenia, 18[2].
variabilis, Orthocladius, 273[7].
varipennis, Chironomus, 190[7], **201**[1].
varipes, Cricotopus, *see* Cricotopus varipes.
varius, Tanypus, **124**[4].
Vayssiere, cited, 18[1], 20[3].
velutinus, Camptocladius, 260[2], 263[7]–**64**[3].
venusta, Ablabesmyia, *see* Ablabesmyia venusta.
venustus, Chironomus, 241[1].
Verloren, cited, 315[4].
vernalis, Chironomus, 243[4].
vernus, Chironomus, 291[1].
Verrall, cited, 117[2], 315[4].
Vespa diabolica, 13[5].
vibratorius, Chironomus, 258[1].
viminal's, Oxyethira, *see* Oxyethira viminalis.
Vinen, cited, 315[4].
violacea, Argia, 14[6].
? virens, Tipula, **230**[6].
virescens, Chironomus, 190[4].
virgo, Polymitarcys, 29[2], 69[1].
viridicollis, Chironomus, *see* Chironomus viridicollis.
viridipes, Chironomus, 211[3].
viridis, Chironomus, 195[2], 227[1], **230**[7].
vitiosus, Ceratopogon, 104[5].
Von Grimm, cited, 312[4].
von Waldheim, Fisher, cited, 315[4].
vulneratus, Chironomus, 230[6].

Wagner, cited, 315[5].
waldheimii, Chironomus, 241[2].
Walker, cited, 109[4], 110[1], 232[6], 245[3], 245[6], 246[3], 246[6], 247[2], 247[4], 247[6], 247[8], 248[1], 248[4], 248[5], 248[7], 267[7], 299[5], 315[5].
walkeri, Ephemerella, 43[6].
Walsh, cited, 18[1], 31[7].
waltlii, Diamesa, *see* Diamesa waltlii.
Wassmann, cited, 315[5].
Water skaters, 14[3].

Weith, R. J., acknowledgments to, 19[6]; mentioned, 30[7], 43[5], 47[6].
Weltner, cited, 315[5].
Westcott, O. S., specimens obtained by, 10[1].
Westwood, cited, 315[6].
Weyenbergh, cited, 111[9], 190[7], 212[1], 216[7], 243[4], 315[6].
White-gloved howdy, 31[5]–36[2].
Wiedemann, cited, 242[7], 315[7].
Willemoes-Suhm, cited, 315[7].
Williston, cited, 77[2], 82[2], 152[6], 233[4], 235[2], 235[6], 236[2], 258[8], 258[9], 315[7].
willistoni, Chironomus, 196[7], **235**[1].
Winnertz, cited, 112[7], 315[8].
Wulp, *see* Van der Wulp.
Wulpiella, 87[5], 90[7], **164**[7]–**65**[2].
scirpi, 164[8]; explanation of plate, 328[5].

Xylocrypta, 93[1], **104**[6].

Young, D. B., mentioned, 30[6], 36[7].

Zeller, cited, 315[8].
Zetterstedt, cited, 77[5], 215[9], 244[2], 273[7], 281[6], 283[6], 305[9], 315[9].
zonulus, Chironomus, 211[5].

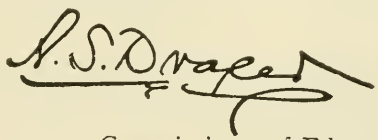
New York State Education Department
Science Division Jan. 19, 1905

Hon. Andrew S. Draper
Commissioner of Education

SIR: I beg to transmit herewith for publication the report of the State Entomologist for the year 1904.

Very respectfully yours
JOHN M. CLARKE
Director

State of New York
Education Department
COMMISSIONER'S ROOM
Approved for publication Jan. 19, 1905.



Commissioner of Education

New York State Education Department

New York State Museum

John M. Clarke Director
Ephraim Porter Felt State Entomologist

Bulletin 97

ENTOMOLOGY 24

20th REPORT OF THE STATE ENTOMOLOGIST 1904

To John M. Clarke, Director of Science Division

I have the honor of presenting herewith my report on the injurious and other insects in the State of New York for the year ending Oct. 15, 1904.

General entomologic features. The season of 1904 is notable because of the remarkably small amount of injury to agricultural crops. Plant lice and pear psyllas, Psylla pyricola Forst., which were so abundant in 1903, hardly attracted attention last season. The pernicious or San José scale insect has become firmly established in certain localities in the State, and the best method of controlling it in commercial orchards is an urgent problem. The elm leaf beetle, Galerucella luteola Müll., has been remarkable for its scarcity and the same is true of a considerable number of the more common pests injurious to garden and field crops. Even the grape root worm was much less numerous in Chautauqua vineyards than in 1903.

Office work. This has been continued as in preceding years, and aside from the natural lack of inquiries due to the paucity of insect life, indicates a most gratifying interest in our work. The determination of scale insects for the commissioner of agriculture, in connection with the nursery inspection work conducted by his department, has made some demands on the office. The first assistant, Mr C. M. Walker, severed his connection with this office Jan. 1, and Mr D. B. Young was promoted to his position. Mr Ivan L. Nixon, a graduate of the Kansas State Agri-

cultural College, was appointed assistant Ap. 1, and has been mostly engaged in field investigations of the grape root worm in Chautauqua county. Correspondence indicates a continued and healthy interest in our work, the slight decrease easily being accounted for by causes mentioned above. 1522 letters, 881 postals, 280 circulars and 1757 packages were sent through the mail during the past year.

Special investigations. The investigations of the grape root worm, Fidia viticida Walsh, have been continued and the results and conclusions of last year's work largely confirmed. Our studies show that by far the most effective method of controlling this species in badly infested vineyards, particularly those where vines are making a rapid growth, is by the employment of beetle catchers, the utility of which was abundantly demonstrated last year. Experiments with arsenical poisons indicate considerable protection if the applications be very thorough.

Investigations of methods of controlling the San José scale, Aspidiotus perniciosus Comst., particularly with lime-sulfur washes, have been vigorously pushed and our earlier results confirmed. It is particularly gratifying to state that we have discovered a new and much easier method of preparing a wash, which appears to be just as efficient as more expensive compounds. A third instalment of the beneficial Chinese lady beetle, Chilocorus similis Rossi, was obtained in early July through the courtesy of Prof. Wilmon Newell, state entomologist of Georgia, and established in an infested orchard at Kinderhook. It was expected that they would multiply rapidly, as had those obtained in preceding years, but for some cause or other there was very little breeding and no lady beetles were to be found on the trees in the fall. It is possible that they spread to other sections and that the species has become established in that vicinity. Scale insects are abundant enough there to maintain the lady beetles, and the species has certainly been given sufficient opportunity to establish itself in this latitude and to demonstrate its value as an aid in controlling the dangerous San José scale.

The studies on aquatic insects, begun by Dr James G. Needham in 1901, have been continued as opportunity offered and an extensive monographic account of the stone flies of the State is now in preparation.

The investigations of mosquitos have been continued and our results are embodied in a bulletin of 164 pages, illustrated by over 300 original drawings or photomicrographs, giving the life history

and describing the immature stages of over 40 species, 12 being characterized as new. The assistant entomologist, D. B. Young, has rendered valuable aid in the collecting, breeding and care of specimens incident to this work.

The office has fortunately been able to avail itself of the services of Prof. Herbert Osborn of Ohio, a well known specialist on leaf hoppers or Jassidae. He has done some special collecting in the State and embodied his results in an annotated catalogue, listing about 175 species, which is reproduced in our report. Mr E. P. VanDuzee of Buffalo, a skilful entomologist and well known authority on Hemiptera, has collected in the Adirondacks and Catskills, and the value of his work is greatly enhanced by an annotated catalogue accompanying his collections, reproduced in our report. His work has added over 1600 specimens representing over 300 species, six of which were previously unknown, to our collections.

Publications. The principal publications of the entomologist, to the number of 67, are listed under the usual head. The more important of those issued during the year, are the following: *Grapevine Root Worm* (Museum bulletin 72), *Monograph of the Genus Saperda* (Museum bulletin 74) by the entomologist and L. H. Joutel of New York, and the *19th Report of the State Entomologist* (Museum bulletin 76). *Mosquitos or Culicidae of New York State* (Museum bulletin 79) was practically completed during the time covered by this report, but owing to delays of one kind or another it was not issued till the latter part of October.

There is in press an important monographic account of the *May Flies and Midges of New York*, by Messrs Needham and Johannsen, and the extensive quarto memoir on *Park and Woodland Insects* is still unpublished.

Collections of insects. Large additions have been made to the state collections during the past season, particularly in the Culicidae, which received special attention during the season of 1904. We now have over 1800 pinned specimens of New York Culicidae representing about 40 species, a goodly majority of the latter having been reared from one or more isolated larvae, thus establishing beyond doubt the specific identity of the two stages. In addition, the 108 specimens representing 63 species, received from Prof. F. V. Theobald, a world-wide authority on Culicidae, brings the total number of species in the collection up to 99, which is increased slightly by the larvae of several others from which adults have not been reared. The usefulness of this collection has been greatly enhanced by the preparation of over 600 micro-

scopic slides showing the minute structures of the different species, and also by over 400 photomicrographs made from these mounts. This mounted and photographed material constitutes a permanent collection which will be of inestimable value in future studies of this economically important and extremely interesting group.

Many specimens have been added to the general collection, particularly in the Hymenoptera and Diptera, and special progress has been made in classifying these important families. The exhibit collection has received a number of valuable additions and in all of our collecting, the needs along this line have been recognized. The exchange system inaugurated in 1903, has been continued with mutually satisfactory results, a most interesting collection of aquatic larvae being received from Dr F. Meinert of Copenhagen, Denmark, and a valuable series of Coccidae from Mr J. G. Sanders of the Ohio State University, Columbus O. Other exchanges of minor importance have been arranged and more are contemplated. The office supervised the preparation of a collection of insects which was exhibited at the Louisiana Purchase Exposition, by the Forest, Fish and Game Commission. It comprised about 250 species, the life history and habits of 140 being represented in greater or less detail. This collection attracted considerable attention and was the object of very favorable comments.

Nursery certificates. Owing to the continued reluctance of the Virginia authorities to accept nursery inspection certificates not indorsed by an official entomologist, we have continued to show our approval of this work by indorsing certificates issued by the commissioner of agriculture, whenever the same was requested. The following is a list of firms to whom these nursery certificates were issued in the summer and fall of 1904: Allen L. Wood, Perry Nursery Co., Herrick Seed Co., First National Nurseries, Brown Bros. Co., T. W. Bowman & Son, Chase Bros. Co., Western New York Nursery Co., Irving Rouse, Ellwanger & Barry, H. S. Taylor & Co., Graham Nursery Co., Allen Nursery Co., W. H. Salten, Green's Nursery Co. and Brown Bros., all of Rochester; T. S. Hubbard & Co., George S. Josselyn, Wheelock & Clark, F. E. Schifferli, Foster & Griffith, Lewis Roesch, all of Fredonia; Bryant Bros., G. A. Sweet, Stark Bros., Sheerin's Wholesale Nursery Co., The Rogers Nurseries, all of Dansville; Jackson & Perkins Co., Knight & Bostwick, both of Newark; R. G. Chase Co., G. B. Willard, Sears, Henry & Co., W. & T. Smith Co., Reliance Nursery

Co., all of Geneva; E. Moody & Sons, D. F. McCarthy, both of Lockport; F. R. Pierson Co., Tarrytown; Lake View Nursery Co., Sheridan.

Voluntary observers. The work of the voluntary observers has been continued. Their reports have largely a negative value this season, owing to the unusually few insect depredations on crops of agricultural importance. A number of valuable statements have been placed on record and we fully expect, as the years continue, that these records will prove of considerable service in throwing light on the oscillations of insect life.

Acknowledgments. Special acknowledgments are due at this time to Dr L. O. Howard, chief of the Bureau of Entomology, United States Department of Agriculture, and to his staff, particularly to Messrs Coquillett and Dyar, who have been very kind in furthering our investigations on mosquitos. Mention should also be made of Dr J. B. Smith, state entomologist of New Jersey, who generously donated for study, examples of rare species.

Respectfully submitted

EPHRAIM PORTER FELT

State Entomologist

Office of the State Entomologist

Albany, Oct. 15, 1904

INJURIOUS INSECTS

Grape root worm

Fidia viticida Walsh

The following observations and experiments are a continuation of those begun in 1902 and continued through 1903. They were carried out under our personal supervision by Assistant Ivan L. Nixon, who was in the field continuously for about two months. The general results of the season's work may be considered as strikingly confirming our earlier experiments and conclusions, and better than this, in adding one more link to the evidence showing that this serious insect pest can be controlled if energetic measures are promptly adopted. Our thanks are due to Messrs D. K. Falvay and E. A. Skinner of Westfield, who kindly placed portions of their vineyards at our disposal for experimental purposes, and also to Mr E. W. Skinner of Portland, for the same courtesy.

Attention is called to the fact that we have attempted to give a precise idea of conditions so far as observations could determine, preferring that to more ambiguous statements which may be influenced by personal judgment. There is no guesswork for example, about the number of insects actually taken from a vine when jarred into a beetle catcher and carefully counted, while an estimate is always open to question. It will also be noted that within practical limits every possible means of estimating actual conditions has been taken advantage of and our field observations confirmed wherever possible, by laboratory experiments. Others have laid considerable stress on the number of egg clusters found on a vine, and could we be sure of counting all deposited in a season, this method affords an ideal way of estimating the activity of the beetles. Unfortunately, the period of egg-laying extends over two months, and it is hardly practical to determine the total number of egg clusters normally laid on a vine, because the earlier ones hatch before the later ones are deposited and the traces of old egg clusters are so slight that they can be easily overlooked. Several observations can hardly be made on the same vine, because the stripping of the bark, necessary to detect the egg clusters, removes shelters and leads the beetles to deposit their eggs elsewhere. Several counts at intervals of a week or 10 days are necessary to the accurate estimation of the total number of eggs deposited on selected vines, since experience shows that the proportion of eggs on sprayed and unsprayed vines changes as the season advances, and if this variation be disregarded, accurate conclusions can not be drawn.

It is not easy to find grubs about the base of the roots, and undoubtedly there is more or less error in attempting to estimate results by this means, still the grubs cause the injury and, on this account, are of prime importance and an estimation of adults, eggs or other stages, is really an attempt to count the grubs. A direct estimation is therefore less liable to error. This method enables us to calculate all the insects under one vine because examinations can be delayed till all the grubs are large enough to be easily detected. Furthermore, this method is almost the only one of estimating the number of insects about a vine during the greater portion of the year. We wish to emphasize the fact that definite figures are given as to the number of beetles on vines in the sprayed and unsprayed areas, and it will be seen that the section selected was sufficiently infested to give a fair test of the value of arsenical poisons. This latter is an essential in experimental work, and unless insects are present in large numbers, unreliable results may be obtained.

Scarcity of root worms. In our search for suitable experimental areas last spring, we experienced great difficulty in finding a place where the insects were sufficiently abundant and the vines at the same time in good condition. Our investigations indicated that for some reason or other, grape root worms were relatively much less abundant than the year before and subsequent observations have tended to support this view. The insects have been exceedingly numerous in a few localities but generally speaking there appears to have been a marked decrease in numbers for some cause or other. Possibly the extremely cold weather may have killed some of the grubs but this hardly seems an adequate explanation. This species is more or less local in habit and therefore a general estimate as to the abundance of the insect is difficult to make without very abundant data, and on the same account it is almost impossible to forecast where it will be present in large numbers another season.

Observations on life history. *Larvae.* The date when the grubs transform to the pupa or "turtle stage," is of considerable importance and consequently our observations of the two preceding years have been checked by those made in 1904. The first pupae observed in 1902, were met with at Ripley June 7, and a great majority of the insects had transformed by June 23. The season of 1903 was more advanced and 90% of the insects on light, sandy loam were in the pupa or "turtle" stage May 29. The first pupae observed in 1904, were met with June 2 on light, sandy soil, and

by the 8th most had transformed to this stage. It will be seen by the above that there is a range of 10 days or two weeks between the transformations of these insects from year to year, and as previously established, an almost equal difference in time between the change on light and on heavy soil; consequently it is necessary for vineyardists who plan to destroy large numbers of the pests by cultivation, to watch closely the development of the insects not only in the vineyard as a whole but in some cases in various portions of it on account of the marked influence on their development exerted by various soils.

Beetles. Our observations of 1903 were largely confirmed by those of 1904. The first beetles observed abroad in 1902, which was a remarkably late season, were met with July 2, while in 1903 a few were taken June 19. The past season was later than the preceding one and none were observed prior to June 29 and in most vineyards comparatively few were met with till early in July. Our cage experiments in 1903 showed that over 92% of the beetles appeared within two weeks after the first were taken and practically none after July 21; in other words, out of 506 bred from under two vines, 477 emerged by July 21. This record is closely paralleled by that obtained in 1904, when 155 beetles, 87% of the entire number, were taken within the first two weeks after the insects began to appear in the cage.

Record of cage experiments 1904

	1 CHECK Beetles counted, none removed		2 ARSENATE LEAD 1 lb to 10 gal.		3 ARSENATE LEAD 1 lb to 10 gal.	4 POISONED BORDEAUX MIXTURE	5 BEETLES COLLECTED	
	VINE 1	VINE 2	VINE 1	VINE 2			VINE 1	VINE 2
GRUBS PLANTED	100, May 24	100, May 26	100, May 26	100 June 1	100, June 2	100, June 2	Small, 20, May 26; 10, June 4; 20, June 9; 13, June 13; 7, June 15; 8, June 16; 15, June 17. Large, 14, June 13; 11, June 15. Total 118	100 large, June 9
DATE								
July 5	.....		.....		.....	.....	3 beetles	
6	.....		.....		.....	.....	33 "	
7	52 beetles		Sprayed 1		Sprayed 1	Sprayed 1	28 "	
9	83 "		.....		.....	.....	21 "	
11	109 "		Sprayed 2		.....	.....	36 "	
13	141 "		.....		Sprayed 2	Sprayed 2, few signs of feeding, no dead beetles	17 "	
15	147 "		Sprayed 3		.....	.....	17 "	
18	120 "		.....		Sprayed 3, no dead beetles	Sprayed 3	6 "	
20	100 "		Sprayed 4, no dead beetles.		No dead beetles, feeding on protected leaves	No dead beetles, feeding on protected leaves	7 "	
23	25 live, 4 dead beetles		Sprayed 5		.....	.....	5 "	
27	.....		.....		.....	.....	3 "	
Aug. 1	.....		.....		.....	No dead beetles	3 "	
2	5 live, no dead beetles, 12 egg clusters		No beetles, 4 egg clusters		1 live, no dead beetles, no egg clusters		Total...179	
8	1 live beetle		No dead beetles		No dead beetles	No dead beetles	No beetles	

This is a slightly smaller per cent than that observed last year, but the cage in which this experiment was tried was planted with a large number of quarter to half grown grubs. An examination in the spring showed that the two vines in cage 5, which we used for this test, were practically free from grubs and as a consequence it was restocked with 140 large grubs and over 60 small ones, making a total of 218. 179 beetles were obtained from these grubs on or before Aug. 1, indicating that some, at least, of the partly grown grubs must have attained full size very rapidly, transformed and emerged within a comparatively short period. It would therefore appear as though the beetles found in the vineyard during the latter part of the season and even into September or October, are in all probability those which have enjoyed a prolonged adult existence of two or more months, rather than belated individuals from the small grubs so frequently met with in early spring. The appearance of beetles above ground, as previously pointed out, is a matter of considerable importance whatever method is adopted for the control of the insect. The period elapsing between pupation and the emerging of the beetles, is a comparatively uniform one and consequently cultivation for the destruction of the pupae should be at a time when most of the insects are in this helpless condition. It is equally important to destroy the majority of the beetles either by collecting or with poison, before they have deposited many eggs, and as shown by our observations of last year, this can be done provided many are collected or killed within 7 to 10 days after they first appear, and then the majority of the remaining beetles destroyed within the next week or 10 days.

Our records regarding the relative abundance of beetles are also confirmed by observations in cage 1, which was planted with 200 full grown grubs [*see* record of cage experiments]. This cage was a check one and the insects were counted as closely as possible at more or less frequent intervals from July 7 onward. It will be observed by referring to the record, that more insects were seen July 13 and 15, within a week or 10 days after they first appeared, than at any other time.

Eggs. The extended observations on the oviposition habits of this species in 1903 hardly required duplication and it is perhaps sufficient to state that no evidence was met with to show that our conclusions in this respect were in the least erroneous. It will be sufficient in this connection to point out the salient features of our earlier studies. In the case of one female we found

that over one fourth of the total number of eggs were laid during the last 10 days after oviposition began, and that nearly one half of the entire number (over 900) were deposited within the first three weeks. These figures were strikingly substantiated by a tabulation of the egg deposits of a number of beetles in various cages, showing that 45% of the entire number were deposited within the first two weeks and that 73% were laid during the month of July; in other words, by far the greater number of eggs are deposited under normal conditions during the first two weeks after the beetles begin to lay or during the first 3 or $3\frac{1}{2}$ weeks of their existence, and consequently it is important to destroy them as early in this productive period as possible.

Value of beetle catchers. Our work in 1902 proved that a hand beetle catcher, of which the so called Hough beetle catcher may be taken as a type, could be used to advantage in small vineyards, though it is a somewhat laborious and slow method of controlling the insect. The larger horse machine, made for us and tried for the first time in 1903, demonstrated the practicability of this method of capturing the beetles. Our three catchings with a few minor ones in early July, resulted in taking over 150,000 beetles from an experimental area of about five acres, and at the close of the summer we estimated that the number of insects had been reduced about 98%. The work of 1904 has been a continuation of that begun in 1902 and further prosecuted last year. We were anxious, among other things, to ascertain if the conclusions of 1903 would be justified by the conditions found in 1904. Sample diggings in the experimental area in the fall of 1903 resulted in obtaining no grubs from three vines, one only from each of three, and two only from two others, indicating that there were very few which had more than 12 or 15 grubs, and that in all probability the number to each vine would hardly exceed 8 or 9. There was a chance that there might be a material difference between conditions in the fall and those of early spring, consequently sample diggings for grubs were made in the spring of 1904, and they may very justly be compared with what was found in the experimental area we selected in the spring of 1903. Similar diggings over the experimental area in the earlier year, gave from 8 to 50 or more grubs, or as calculated, from 60 to 400 or more to a vine, and in one case it was estimated that there were fully 1000 under a single vine. The following table of grubs taken in the Falvay vineyard in 1904, reveals a very striking difference.

Record of grubs taken in Falvay vineyard 1904

ROW	May 24	June 1	2	3	9	10	11	13
8	4							
13							0	
14	2							
15	0					1	0,0	
16							0	
17							0	
18						2	0,0,2	
19		2,7,10				1		
20		0,7,20,0,6			1,7,1	2		
21	15,17	6,3,5,5			1,0	0	0	
22			4,53,8,7,4		2		0	0
23	10		7,4,5,1		1		2	0,0,1
24	2		1,3,0				1,0	
25	3,6	2,3,1,8						1
26	1,6	4,2,3						
27				9,3,0,4,4				
28				0,2,4,0,0,4				
30				0,0,0,1				
31	2							
32	0							
36	1							
39	3							
45	3							

It will be observed that in comparatively few cases only, were more than eight grubs found under a vine, and in the one case where 53 were taken from under one, these were obtained only after extended diggings under the entire vine, whereas all of our sample diggings in the spring of 1903, did not, as a rule, comprise more than a quarter of an arc and even then were limited to a small area in the immediate vicinity of the stem. Most of the sample diggings in the spring of 1904, averaged larger than those of the preceding spring, and in the case where 15 and 17 respectively were found in row 21, May 24, one third to one half of the entire area in the near vicinity of the stem was excavated in search of the grubs taken. It will also be observed that in a great many instances none were found, showing a striking difference as compared with the year before.

The efficacy of last year's collecting with a horse machine, was further tested by operating the same apparatus over the experimental area in the season of 1904. Three collectings, as in the preceding year, were made; the first July 1 and 2, the second about the 12th, and the third from the 16th to the 19th. The total collections on each of these dates amounted respectively to 5312, 2003 and 1925, a total of only 9240, which should be compared with the 154,900 taken from the area the preceding year. It should be remembered, however, that these figures do not represent the actual decrease in the number of insects destroyed, because the survivors of our operations in 1903, had an opportunity to

multiply and consequently while we captured about 94% less insects, the actual reduction was considerably more, as allowance should be made for a normal increase.

Table of beetles taken with Morehouse catcher 1904

Rows	1st collecting July 1, 2	2d collecting July 12	3d collecting July 16-19
1-18	738	.....	357
19-24	311	253	105
25-30	526	325	191
31-37	669	523	205
38-50	1 340	512	508
51-61	1 467	300	390
62-63	261	.....	169
Totals	5 312	2 003	1 925

Grand total 9240, a reduction of 94%

The operations of 1904 showed that under certain conditions considerable shelling of the grapes was likely to result unless great care was exercised in jarring. The relief, as the result of cultivating and collecting, is so great that wherever a vineyard is badly infested with beetles, there can hardly a question arise as to the advisability of sacrificing, if need be, a few grapes for the sake of practically freeing an infested area from such a dangerous enemy of the vines.

Experiments with arsenical poisons. It is very difficult to secure reliable data on the efficacy of poisons for controlling this insect. The beetles do not succumb quickly and therefore we do not find many dead on the ground at any one time, which would be conclusive evidence of their being destroyed by poison. Secondly, the beetles exhibit a marked preference for unsprayed foliage and in search therefor frequent concealed, unsprayed leaves and probably, when flying about the vineyard as they do more or less, work from the poisoned to the unpoisoned vines. Naturally those finding themselves on wholesome foliage, are inclined to remain there and as a consequence large areas uniformly infested with a great many beetles, are necessary for satisfactory results. It is obviously unfair to compare sprayed rows with closely adjacent unsprayed ones because the activity of the beetles would naturally lead them to fly more when on sprayed vines and less on untreated ones,

which are much more to their liking, consequently there is a strong tendency to collect on near-by unsprayed foliage whenever possible. This makes comparisons between sprayed and unsprayed vines side by side or even within two or three rows of each other of slight value, and has rendered it very difficult to find conditions suitable for an exhaustive test of poisons. Another important adverse factor is the liability of the insects forsaking the experimental area, not because there is poison on the vines but for some unknown reason. A number of such cases have been brought to our notice and conclusions must therefor be reached with extreme caution.

The results obtained with these materials in 1902, were exceedingly unsatisfactory and it was then thought that the very unfavorable weather afforded at least a partial explanation therefor. The experiments were continued in 1903, and a series of plots for testing the relative merits of arsenate of lead, paris green and poisoned bordeaux mixture in connection with cultivating for the destruction of pupae and collecting of the beetles, were planned. The spraying operations were conducted as outlined but owing to the likelihood of there being large numbers of eggs deposited in the sprayed areas, at the last moment it was decided to collect over the same and thus save the vineyard from serious injury it could ill afford, as it had suffered severely the preceding year. The areas infested with root worms, were carefully examined in the spring of 1904, for the purpose of finding if possible, thrifty growing vineyards, moderately to rather badly infested with beetles, and after an extended search one was selected near the center of Westfield, known as the Cowden vineyard, and another in Portland, belonging to E. W. Skinner. Grubs were abundant in both in early spring, but for some reason or other comparatively few beetles emerged or were to be found later in the Cowden vineyard at Westfield, and consequently most of our experimental work with arsenical poisons, was limited to Portland. The experimental area consisted of about one acre of nearly level vineyard and comprised 10 rows, the southern portion being more infested than the northern. June 30 this experimental area was sprayed very thoroughly indeed; four barrels of spray and 15 pounds of arsenate of lead were used. Two nozzle extensions with hose of different lengths were employed, one with two and the other with three cyclone nozzles. One man gave particular attention to the upper portion of the row and the other following behind to the lower, the spraying being repeated on the opposite side of the row and thus the foliage was covered as thoroughly as possible with

poison. An examination in the vineyard at the time showed that the beetles were abundant, having recently emerged, and as many as 20 were observed on a vine, and in one instance nine were seen within a small area of about 9 inches, the insects resting on the top wire and adjacent stems. There was considerable feeding in the vineyard at the time of treatment, which latter had been delayed somewhat because of the grapes being in bloom. A second spraying was given in the same manner July 6. At this time much feeding was observed and numbers of the beetles were pairing. The following table gives in a summarized form the conditions as observed in the experimental area and the section adjacent thereto, which was used as a check.

Table of spraying experiments at Portland 1904

		BEETLES CAPTURED					EGG CLUSTERS FOUND				GRUBS FOUND	
	Date	July 6		July 11	July 14	July 20	July 25	July 29	Aug. 5	Aug. 8	Oct. 3	
	Rows	North end	South end								North end	South end
Sprayed	1	.....	27	.....	18	.....	.....	.....	.....	.....	1	2
	2	.....	55	.....	46	11	.....	.....	.....	.....	3	4
	3	.....	.....	6,9,13,19	22	14	.....	.....	.....	.....	...	0
	4	.....	.....	5,8,13,22	15	14	2,2,0,2,1	.....	.....	.....	2	3
	5	5,16,6	33,46	14,25,9,9	19	5	3,3,2	.....	1,4,5,3,6	.....	4	4
	6	.....	58	23,24	25	17	.....	.....	.....	7,3,2,5,6,4	3	7
	7	15	.....	.....	23	19	.....	.....	.....	.....	...	5
	8	8,11	.....	25,20,24	23	16	.....	5,2,3,1,3,4	.....	.....	5	6
	9	.....	.....	39,15	29	5	.....	.....	.....	.....	...	4
	10	.....	55,54	.....	25	10	.....	.....	.....	.....	4	5
Unsprayed	11	.....	79,79	.....	51	14	.....	.....	.....	.....	5	6
	12	.....	.....	18,34,31	60	14	.....	.....	.....	.....	...	6
	13	.....	.....	31,30,30, 57,49	42	15	.....	.....	.....	.....	6	7
	14	.....	.....	.....	53	9	.....	.....	.....	.....	5	9
	15	.....	53,95,32. 24,27,15	.....	58	12	.....	.....	8,10,9,13, 11	.....	6	8
	16	.....	.....	.....	43	13	14,6,5,5,20	.....	.....	.....	4	....
	17	.....	.....	77,38	51	15	.....	18,9,9,19, 13,15	.....	.....	7	....
	18	.....	.....	40,32	40	.....	.....	.....	.....	.....	....	.....
	19	.....	.....	.....	34	.....	.....	.....	.....	.....	...	6
	20	.....	.....	.....	49	.....	.....	.....	.....	.....	...	8

It will be observed on referring to the two columns under date of July 6, that the beetles were decidedly more abundant in the southern than in the northern end of the plat, as previously stated. The separate figures given in each space refer to the number of beetles, egg clusters or grubs taken on or under individual vines, and when more than one is given, it means that several in the same row were examined. The experimental area was carefully watched from time to time, and at more or less regular intervals a Hough beetle catcher was used to collect the beetles from single vines in order to ascertain the number present in various portions of the treated and untreated areas. It is interesting in this connection to compare the average number of beetles on vines about the middle of the sprayed and unsprayed areas; in other words, on rows 3 to 7 in the sprayed area and rows 14 to 18 in the unsprayed section. In the former there were, July 6, 45.66 per vine; July 11, 12.8; July 14, 21.2 and July 20, 13.8. These figures should be compared with the following from the unsprayed area. July 6 there was an average of 41.66 per vine; on the 11th 57.5; on the 14th 49 and on the 20th 12.25. It will be seen that the numbers were approximately equal on the first and last named dates, and the considerable discrepancies observed on the 11th and 14th are probably to be explained in a large part by the effect of the poison applied June 30 and July 6. Still the above data hardly allows us to accurately estimate the total number of beetles destroyed. July 6 there were signs of considerable eating on both sprayed and unsprayed rows, it being specially evident on the latter. We consider this somewhat unreliable evidence as to the amount of protection afforded, since the beetles on sprayed vines feed to a considerable extent on sheltered leaves and in places hidden from observation, evidently in an attempt to find foliage free from poison. An examination July 8, nine days after the first spraying and two after the second, resulted in finding the remains of 9 dead beetles under about 15 vines in the southern section of the vineyard. There were a great many living, apparently healthy insects on the vines, and there appeared to be no marked inclination to forsake the sprayed area. The jarring of a typical vine in row 6, resulted in the capture of 35 beetles, and another in row 13 in taking 61 beetles. July 11 the remains of 7 or 8 dead beetles were found after an extended search under about 15 vines, and on the 16th it required two hours to find two dead insects under a number of vines, indicating plainly that comparatively small numbers were killed by the poison. An examination July 21 resulted in taking

11 beetles from a sprayed vine and 12 from a similar one in the unsprayed area, and at that time there appeared to be just as many beetles on the sprayed as on the unsprayed area.

A study of the egg clusters taken on vines in both the sprayed and unsprayed areas, is interesting and considerable variation in the numbers will be observed. Comparisons of the numbers of egg clusters taken from vines in the middle of the treated and untreated areas (rows 3–7 and 14–18), show that in the sprayed section July 25 there was an average of .7 of a cluster per vine; on the 29th an average of 3, and Aug. 5 an average of 4.8 clusters per vine, whereas in the unsprayed area there was, July 25, an average of 5 egg clusters per vine; on the 29th an average of 12⅛ clusters per vine, and Aug. 5 an average of 10.5 egg clusters per vine. Averaging each of these we find that during the entire period there was an average of 2.82 egg clusters per vine on the sprayed area and of 9.16 on the unsprayed area[1]. This appears like a very substantial reduction in eggs, and were it borne out later by an examination for grubs around the roots, we would be inclined to accept it at its face value. Unfortunately such is not the case, and for some reason or other, if the above figures are correct, there had been a greater mortality among the eggs deposited on the unsprayed than among those deposited on the sprayed vines, as examinations in October, extending across the entire area, show that on the southern portion of the vineyard we had an average of 4.75 grubs per vine on the sprayed area and of 7.4 grubs on the unsprayed area, indicating a reduction of less than 50% on the worse infested section. A comparison of vines on the northern portion of the experimental plots, where the beetles were not present in such large numbers, shows that there was an average of 2.2 grubs under the sprayed vines, and of 5.5 grubs under unsprayed vines, indicating a decrease of a little over 50%. Considering the entire data, we find an average of 3.47 grubs under the vines on the sprayed area, and one of 6.45 grubs under the unsprayed vines. It will be seen that in the case of both beetles and eggs, the relative proportion of each on the sprayed area increases with the advance of the season, and that consequently it is almost impossible by a single examination to correctly estimate the value of the spraying. Reliable data apparently can be obtained only by digging about the vines in order to estimate

[1]The percentage reduction, 86 % does not differ widely from that obtained about the same time by Messrs Slingerland and Johnson, namely 93–95 %. The significant feature is that these percentages are true for only a limited period and the real protection from spraying is considerably less. [*See* C. U. Exp. Sta. Bul. 224, p. 67]

the number of grubs, which as previously pointed out, are the destructive agents the grower wishes to eliminate from his vineyard.

It is interesting in this connection to refer to the mortality and egg records of beetles from the experimental areas. This was another effort to learn by indoor observation, more of what was actually taking place outdoors, and the general plan was to catch beetles at approximately regular intervals, taking some from both the sprayed and unsprayed areas, and feeding a portion of those from the former on sprayed foliage and the remainder on unsprayed leaves.

Mortality and egg record of beetles from experimental areas 1904

	Date of capture	Number taken	July 9	July 11	July 13	July 16	July 19	July 20	July 23	July 25	July 27	Aug. 1	Aug. 6	Aug. 12	Aug. 17
From sprayed fed sprayed	July 6	15	3 dead	3 dead	2 dead	2 dead 1 missing	2 dead	all dead							
	July 8	15		2 dead	4 dead	2 dead	4 dead	2 dead				all dead			
	July 11	11			2 dead	3 dead		all dead							
	July 14	16				6 dead	9 dead	all dead							
	July 25	11									6 dead	all dead			
From sprayed fed unsprayed	July 6	19				eggs	2 dead		1 dead			5 dead	2 dead	4 dead	4 dead 3 living
	July 8	15			eggs		1 missing		2 dead; eggs	1 dead; eggs		eggs	4 dead; eggs	all dead	
	July 11	10			1 dead	3 dead	3 dead			eggs	eggs		eggs	all dead	
	July 14	16				4 dead	6 dead	3 dead				eggs	eggs	all dead	
	July 25	11									1 dead	4 dead	4 dead	1 dead	1 living

From unsprayed fed unsprayed	July 6	35			5 eggs	2 dead; eggs	2 dead	2 dead		1 dead	1 dead	5 dead	5 dead	all dead	
	July 8	23			5 eggs	eggs	1 dead	2 dead	1 dead		eggs	3 dead	4 dead; eggs	6 dead	2 dead 4 living
	July 11	20				eggs			2 dead; eggs			2 dead; eggs	1 dead; eggs	8 dead	2 dead 5 living
	July 14	22				2 dead; eggs	1 dead	2 missing	eggs			eggs	2 dead; eggs	5 dead	7 dead 3 living
	July 25	15											1 dead; eggs	4 dead	6 dead 4 living

Reference to the table shows that beetles taken on the sprayed area and fed on sprayed foliage, all died within a comparatively short time, specially those captured about the middle of July and later. Those taken on the sprayed foliage and fed on unsprayed leaves, lived a considerably longer time, deposited more or less egg clusters, and in general compared very favorably with those taken on unsprayed foliage and fed leaves that had not been poisoned. These records were made by Mr Nixon, and he states that those fed on sprayed foliage appeared to die as much from starvation as from the poison, and this seems very probable, since we know that in vineyards the beetles exhibit a marked preference for unpoisoned leaves. This latter table in connection with the field experiments, clearly shows that some of the beetles can be destroyed by arsenical sprays, and if the vines are kept covered with poison a considerable degree of protection results. It is difficult to state the precise amount, but from data at hand we are inclined to place it at from 50 to 60%, possibly more. Much depends on the thoroughness with which the work is done, and in the case of very rapidly growing vineyards like Mr Falvay's, in which we experimented last year, the protection would probably be much less. This is borne out by reference to our beetle catcher records [*see* p. 371], where it will be observed that fully as many beetles were taken on the rows treated in 1903 with arsenical poisons, namely numbers 25 to 61, as from any other section of the experimental area. A single application of poison was made in this instance and under such conditions it can hardly be considered as having checked the insect to a marked degree. Sprayings should be made at intervals of not over four or five days after the beetles become abundant, and if three can be made at four day intervals it is very likely that much greater protection will be obtained than if only two were made at five or six day intervals.

Restoration of injured vineyards. One of the most serious troubles with this pest, has been that considerable if not a large proportion of the injury is inflicted before the vineyardist is aware of the danger. Watchfulness will, to some extent, obviate the trouble but in many cases the pest becomes abundant before the owner knows of its presence and much damage is caused at the outset. Our experiments in Mr D. K. Falvay's showed that it was possible for the roots to be badly scored by the grubs and yet the vines recover with comparatively little loss of vitality, provided remedial measures are promptly adopted. The roots

in that vineyard were badly wounded in the spring of 1903, and had the pest been allowed to breed in abundance through that summer, we are quite confident that a large proportion of the vines would have been almost ruined because they were not in a condition to withstand another attack. The prompt removal of a very large number of the insects allowed the vineyard to recuperate. We have been observing from season to season other vineyards where the insect has appeared in destructive numbers and caused considerable loss, practically making it impossible to secure any crop for several years. Such vines, having been cultivated and fertilized liberally, appear to be returning, though slowly, to a nearly normal condition, and in another year or two it may be expected, unless they are again injured by large numbers of the pests, that full crops may be secured. The principal factors in restoring a vineyard suffering from root worm attack, is first to see that it is largely freed from the insects and then assist the vines to regain strength by good cultivation, liberal fertilizing, and specially by trimming severely, so that a large amount of the vine's energy will not be absorbed in making useless wood. The process of restoration may occupy two, three or possibly four years, dependent very largely on the severity of the initial injury and also on the care and cultivation given. It is much more satisfactory and profitable to check this insect before serious damage has been caused.

Recommendations. There is no doubt as to the value of cultivation for the destruction of pupae, and wherever the beetles are at all abundant we would advise as heretofore, that vineyardists plan if possible to have a ridge of firm earth at the base of the vines either in the fall or early spring, and to remove the same with a horse hoe or other implement when the great majority of the insects are in the "turtle" or pupal stage, which is normally from the first to the middle of June.

This measure may well be supplemented by destroying beetles, either by the employment of a beetle catcher or with an arsenical spray. The use of the former is preferable in all vineyards where the insects are very abundant and particularly where the vines are growing vigorously. The latter may be employed with safety wherever the vineyard is not badly infested, and particularly on vines not growing rapidly. This is specially advisable where the berry moth is at all prevalent, because there is no doubt but that the poison kills over half of these insects, and this benefit should be taken into account when deciding on the method of destroying

the beetles. It should be remembered, however, that if poisons are employed the application should be most thorough, and it is probable that an outfit capable of developing a high pressure and delivering an extremely fine, mistlike spray, would give better results than one where the spray is coarser and consequently does not drift in among the leaves to so great an extent.

Our observations show that it is much better to fight this insect at the outset and prevent serious injury to a vineyard, rather than to take chances and spend three to five years in getting the vines back into fairly good condition.

Gipsy moth

Porthetria dispar Linn.

This introduced pest is well known by reputation throughout the United States, and owing to the discontinuance of exterminative measures in 1900, by the commonwealth of Massachusetts, the insect has been allowed to breed more or less undisturbed in many sections and as a consequence has become exceedingly abundant. This condition of affairs, while primarily affecting the residents of the infested districts, is of much importance to those outside because the danger of the pest spreading into other sections is vastly increased. The injuries in 1903 and 1904 were so severe that there was a strong agitation in favor of the resumption of exterminative or repressive measures, particularly if the general government could be induced to take up the work. The secretary of agriculture, Hon. J. Lewis Ellsworth, has been a prime mover in this matter because he and the members of the State Board of Agriculture are in a position to appreciate the gravity of the situation. Several conferences were called during the summer of 1904, and a number of interested parties visited the infested section in order to gain a better idea of actual conditions. The entomologist, in company with Mr G. G. Atwood of the Department of Agriculture, and several others, went over a portion of the infested section July 20. The party started at Malden, driving from there to Oak Grove, over into Melrose, then to Medford and back to Malden, some two hours and a half being spent in the worst infested portions. Generally speaking, most of the street trees and those in private yards showed little evidence of injury by the pest, though occasionally a small orchard or a few trees which had evidently been neglected were seriously hurt. The most destruction was in woodlands, where conditions render it much more difficult to

control the insect, and in the vicinity of Malden it is stated that an oak forest of some 2000 acres, practically cleared of the moth when the work was suspended in 1900, was completely defoliated, and from what was seen the statement is entirely credible. Many acres of woodland were stripped practically clean of foliage and in several places a large number of trees had succumbed, and other areas were observed where the forest growth had evidently been cleared off because of previous injuries by the gipsy moth larvae. Many males and females were observed at the time of our visit, together with numerous egg clusters, though some larvae were present in certain places and there were many pupae. Large numbers of the infested trees were literally plastered about the base with moths and egg clusters, and adjacent stones and other objects were similarly ornamented.

The present distribution of the gipsy moth, so far as known, includes practically all of the territory given in the latest maps published by those engaged in the work, and in addition, colonies are known to occur in Billerica and Newton, which seem to be the westernmost points, and in Bridgewater and Scituate, the southernmost extension of the insect with the exception of the colony in and about Providence R. I. A most serious aspect of the situation is, that some of the worst infested localities are in the vicinity of railroads, and Prof. A. H. Kirkland reports finding eggs on freight cars. These eggs, as is well known, remain unhatched over winter and there is no knowing where the insect may establish itself another spring. It would in all probability be in the vicinity of a railway station. Aside from this source of spread there is great danger in moving boxes, barrels and almost any material near trees inhabited by the pest, because these eggs masses, while conspicuous, are deposited in all manner of places and unless one is familiar with their nature they could easily be overlooked. The situation is such as to greatly increase the chances of the insect being brought into the State, and on that account all are advised to be specially watchful for its advent, and in any case where there is the least suspicion as to the identity of insects found, to send them to this office rather than to allow false reports of the occurrence of the gipsy moth to be given out. These latter simply occasion undue alarm without any benefit resulting therefrom. This species may appear in New York State within a year or two though we hope that its introduction may be deferred for a decade or more.

Description. The eggs of this insect are deposited usually in round or oval patches on a piece of bark and then covered with buff colored scales from the underside of the female's abdomen. A completed egg mass looks very much like a small oval section of a sponge. These masses may be found on stones, in tin cans and in fact on almost any fixed object near at hand, preferably on the under surface, particularly of limbs, fence rails, window sills, etc. The egg itself is nearly globular, pale yellowish or salmon-colored, about $\frac{1}{20}$ inch in diameter, and there are usually 400 to 500 of these in a cluster, though occasionally 1000 occur in one mass. The young caterpillar is slightly over $\frac{1}{10}$ inch long just after it emerges from the egg. It has a black head, the body is brownish yellow and well clothed with long hairs. There is on either side of the segment next the head, a prominent haired tubercle, which gives the young caterpillar in particular, a peculiar broad-headed appearance. The markings become plainer as it increases in size, and when full grown it is from 2 to $2\frac{1}{2}$ inches long or about the size of our common tent caterpillar or the forest tent caterpillar. It may then be recognized by the eight bluish tubercles or swellings in a double line on the anterior dorsal portion of the body, and the 12 reddish ones in a double line on the posterior dorsal part of the caterpillar. In addition, there are four bluish tubercles or elevations just behind the head. The general color of the full grown caterpillar is brownish yellow with dark brown, in some cases almost black markings. The somewhat conical, dark brown pupa ranges from $\frac{3}{4}$ to $1\frac{1}{2}$ inches long and is usually found lying among a few threads spun on bark, stone or other support and securely attached to these filaments by its terminal spine.

The moths differ very greatly. The male is a slender, olive brown, black marked insect with beautifully feathered antennae and a wing spread of about $1\frac{1}{2}$ inches. It flies in the late afternoon and early evening. The female is much heavier and lighter colored. She has a wing spread of about 2 inches and is white or buff white with more or less distinct wavy, black markings. The abdomen is tipped with buff. The female does not fly though she apparently has well developed wings.

Recommendations. Investigate anything that arouses a suspicion that it may be the gipsy moth, but be in no undue haste to identify the insect. It will be much more satisfactory to submit specimens to an entomologist than to arouse unnecessary fears.

The habits of the insect are such that it can be controlled comparatively easily in orchards and on cultivated trees, and we would by all means advise repressive if not exterminative measures wherever it becomes established in small numbers at some distance from large colonies. Such points of infestation should be made known as soon as discovered, in order that adequate steps may be taken to prevent unnecessary spreading.

A more detailed account of this species, together with colored illustrations of its various stages, is given in the *16th Report of the State Entomologist 1900.*

Brown tail moth

Euproctis chrysorrhoea Linn.

The brown tail moth, unlike its introduced associate, the gipsy moth, spreads rapidly because both sexes fly readily, and though it was not discovered in this country till nearly 10 years after the gipsy moth was detected, it has already spread over a much larger area. This species was also a subject of observation when the territory infested by the gipsy moth was inspected last July. Many of the peartrees in Malden, Medford and vicinity were partially or entirely defoliated by the caterpillars, and at the time of our visit several tents of the young insects were seen, showing that another brood had begun its operations. The moths had been flying in immense numbers only a week or 10 days before, being so abundant as to arouse general interest and provoke lengthy notices in some of the leading city papers. This species now occurs as far west as Worcester and Westminster, Mass. It has also invaded New Hampshire and a colony has been established for some years at Kittery Me. This species is not only a destructive leaf feeder, exhibiting marked preference for the pear, but the irritating hairs from the caterpillars are exceedingly annoying, producing a very uncomfortable rash which, in some cases, is so severe as to cause illness.

Description and habits. The eggs are laid in July in masses composed of from two to three hundred and are usually placed on the underside of the leaves, where they are covered with brown hairs from the tip of the female's abdomen. They hatch in a short time and the young feed during the rest of the season on the surface of the leaves, a few only being required to skeletonize them. The caterpillars begin to make the nest or tent in which they hibernate, while still young. It is constructed on the twigs and is made by drawing together a few leaves, lining them with silk and inclosing them with a mass of silken threads. These tents are so firmly secured to the twigs that they can not be removed without considerable force. There is no danger of confusing the tents of this species with those

of our apple tent caterpillar, Malacosoma americana Fabr., since those of the latter are in the fork of the branches, while the tents of the brown tail moth are at the tips of the branches and securely attached thereto by broad bands of silk. The apple tent caterpillar rarely attacks pear, while this food plant is a favorite with the brown tail caterpillars. The web nests or tents of the fall web worm, Hyphantria textor Harris, occur on the trees at the same time as those of the brown tail moth, but they are of an entirely different character, inclosing as they do all of the leaves on the tips of one or more branches and never being firmly attached to the twig. The caterpillar of the brown tail moth ranges from 1 to 1¼ inches in length. The pale brown head is mottled with dark brown and has reddish brown hairs scattered over its surface. The body is dark brown or black with numerous fine, dull orange or greenish spots over the surface, which are most pronounced on the second, third and fourth segments. Long, reddish brown, finely barbed hairs arise from all the tubercles and white branching hairs from the upper side of the lateral tubercles on segments 4-12 inclusive. These white hairs form elongated, white spots along each side and are one of the most striking characteristics of this caterpillar. The subdorsal and lateral tubercles on segments 4-12 inclusive, are covered with fine, short spines of uniform length. There is a bright red, retractile tubercle on top of the 10th and also one on the 11th segment. The moths have a wing spread of about 1¼ inches, are pure white with a satiny luster on the fore wings and a conspicuous reddish brown tuft at the tip of the abdomen. Sometimes there are a few black spots on the fore wings. The antennae are white and fringed with pale yellowish hairs. This species has been treated at some length and illustrated in its various stages in the *18th Report of the State Entomologist*, pages 94–99.

Remedies. It is impossible to exterminate this species, but it may be kept in check by cutting off and burning the hibernating nests in winter, at which time they are readily detected. The species is also amenable to spraying with an arsenical poison, and on account of the severe irritation resulting from the hairs blown from cocoons, it is by all means advisable to prevent this insect from becoming abundant.

Experiments in controlling the San Jose scale

Aspidiotus perniciosus Comst.

The field experiments begun by this office in 1900, were continued in part during the season of 1904 and data secured which has greatly increased our belief in the efficacy of lime-sulfur washes for the

control of the San José scale. There is still considerable diversity as to the best formula and method of preparation, and much attention has been given to this phase of the subject because a slight saving in either material or time amounts to a great deal in the aggregate, when allowance is made for the large amount of spraying necessary. There is in New York State a great demand for a reliable wash which can be prepared very quickly and particularly for one which does not require the prolonged boiling of a large amount of liquid. Such a wash may be prepared with the aid of caustic soda, which material appears not only to facilitate the solution of the sulfur but the heat generated by it also aids in hastening chemical combination between the sulfur and the lime. This process was first brought to notice by the late Prof. V. H. Lowe of the State Agricultural Experiment Station at Geneva, and further work has been done with it by Prof. P. J. Parrott, his successor. Some preliminary laboratory experiments with ordinary washing soda in place of the caustic soda were somewhat surprising to us, and so far as both laboratory and field experiments go, we have had much better success in securing a combination between lime and sulfur with the use of this material than when the caustic soda was employed. Washing soda or sal soda has the advantage over caustic soda in that it may be obtained almost anywhere, requires no special care in handling prior to its use, and is a material with which most people are familiar. The spring experiments with this wash conducted in 1904, indicate a high degree of efficiency, apparently equal to that of a lime-sulfur wash prepared in any other way.

Laboratory experiments with lime-sulfur combinations

It has been very difficult for the entomologist to secure much information regarding the chemical behavior of lime and sulfur when boiled together, either by themselves or in association with salt, caustic soda or other materials supposed to facilitate chemical combination. This led us to experiment with a few of the more common materials, first in the laboratory to ascertain their behavior there, and then in the field to see if the work on a small scale would be borne out by operations with larger amounts. The following observations on experiments in a small way are placed on record, since they may prove of service to others interested in solving these problems and specially because they form a basis for our work on a larger scale.

Laboratory experiments with lime-sulfur combinations

Wash	Lime	Sulfur	Soda bicarbonate	Soda sulfid	Water	Length boil	Color	Character precipitate	Color liquid	Precipitate after 24 hours
1	2 oz	1 oz	1 oz		1 qt	15 min.	Brick-red	Very fine	Orange	No crystals
2	1¼ oz	1 oz	½ oz		1 qt	30 min.	Brick-red (lighter)	Fine	Brick-red	Numerous brick-red crystals
3	1¼ oz	1 oz	½ oz		1 qt	30 min.	Brick-red	Flaky, coarse	Brick-red	Brick-red crystals in greenish precipitate
4	1¼ oz	1 oz	1 oz		1 qt	30 min.	Orange	Very fine, a few flakes	Brick-red	Numerous brown crystals in rather coarse precipitate
5	2 oz	1 oz	1 oz		1 qt	15 min.	Red	Fine, few sulfur flakes	Pale brick-red	Fine
6	¼ oz	1 oz	1 oz		1 qt	15 min	Deep orange	Fine, somewhat flaky	Deep red	Fine
7	2 oz	1 oz	1½ oz		1 qt	15 min.	Deep orange	Less flaky, more perfect than no. 6	Deep red	As before
8	2 oz			2 oz	1 qt	15 min.	Slate color	Coarse, heavy	Colorless	As before
9	¼ oz	⅜ oz		⅜ oz	1 qt	15 min.	Green then orange			

Wash 1. Prepared Ap. 1, 1904. Water was brought to a boil, lime put in, and as soon as the slaking was well begun, the soda carbonate was added, followed immediately by the sulfur. Chemical action began at once and a change in color from white to orange, to red, to brick-red, was observed. At the end of 15 minutes a deep brick-red color showed that considerable combination had taken place. The solution was good, strongly alkaline, and on being allowed to settle, a clear orange-colored liquid was left. The precipitate is very fine with no tendency to crystallize, even on the 5th.

Wash 2. Prepared Ap. 2. Water was brought to a boil, lime put in and the carbonate of soda added as above, and also the sulfur. Chemical action began at once and the color changed from white to purplish orange, orange-red and then to a brick-red, though not so deep as that noted above. The combination was slower and a less amount apparently, combined and dissolved and the precipitate was coarser. On being allowed to settle a brick-red colored liquid was left, and on the 4th numerous brick-red crystals were observed throughout the body of the precipitate and the same was true on the 5th.

Wash 3. Prepared Ap. 2. Water was brought to a boil, the carbonate of soda added, followed by the sulfur. It was stirred five minutes and the lime then added. A flaky precipitate was formed on the addition of the lime which was not dissipated by boiling. The solution contained many flakes at the end of 30 minutes. Colors were apparently about the same as in no. 1. On the 4th many very light flaky particles were observed near the top of the nearly brick-red liquid, and numerous brick-red, needle-shaped crystals were observed in the somewhat greenish, rather coarse precipitate at the bottom. This condition continued on the 5th. Combination was not nearly so satisfactory as when the lime, soda carbonate and sulfur were added in the order given.

Wash 4. Prepared Ap. 2. The lime was added to the almost boiling water, and as soon as slaking began, carbonate of soda was put in, followed immediately by the sulfur. Chemical action began at once and was slower than in no. 1, 30 minutes boiling being required for an approximately equal combination. The solution then was orange in color, very similar to no. 1, although showing a few more flakes and being a little coarser. On the morning of the 4th the brick-red colored liquid above was fully as darkly colored as in no. 1, but numerous brown, needle-shaped crystals had formed throughout the rather coarse precipitate, as in the case of

nos. 2 and 3. It differed from the latter, however, in having practically none of the light flaky precipitate noted above.

Wash 5. Prepared Ap. 4. The lime was added to almost boiling water, and when the slaking began, the carbonate of soda was put in, followed immediately by the sulfur. The chemical action was rather slow and the sulfur dissolved somewhat slowly. At the end of 15 minutes a considerable combination had been effected, though there were a few flakes of sulfur. Examination on the morning of the 5th showed that the precipitate was fine and the clear liquid above was a pale brick-red. Combination was perhaps not quite equal to that of wash 1.

Wash 6. Prepared Ap. 4. Water was not quite as warm when the lime was added, as in the previous combination and consequently slaking was much slower. The carbonate of soda was added and sulfur immediately thereafter. The chemical action was much slower, the solution more flaky and of a deeper red color than in no. 5. Examination the 5th showed that the colored liquid above was slightly darker in color, while the precipitate seemed to be as fine as that in no. 5.

Wash 7. Prepared Ap. 4. The lime was added to boiling water and slaking began immediately. Carbonate of soda was then put in and followed at once by sulfur. Chemical action was prompt and an orange color was obtained much sooner than in either nos. 5 or 6. At the end of 15 minutes there were less flaky particles and the wash was more perfect than no. 6, though the color was about the same. Examination on the morning of the 5th showed practically no changes.

Wash 8. Prepared Ap. 4. Water was brought to a boil, the lime added, and after it was well slaked the sodium sulfid was put in. A dirty bluish green or slate-colored solution was formed. The precipitate is somewhat coarser than that in either washes 1, 5, 6 or 7 and appeared to settle much more rapidly, leaving above a clear colorless liquid. If the color is any indication, there was practically no combination between the lime and the sulfur in the sodium sulfid.

Wash 9. Prepared Ap. 4. The lime was added to the water when it was nearly boiling and allowed to slake; sulfur was then put in, and in about 30 seconds the sodium sulfid was added. The color appeared in a very short time, a purplish tinge was noted, which changed to green, and after six minutes boil to orange which remained in evidence during the entire 15 minutes. An examination on the 5th showed that this precipitate was hardly

as coarse as that in no. 8, and the clear liquid above has a distinct brick-red color, due probably to the presence of calcium sulfid, indicating some combination.

Wash 10. Prepared Ap. 4. This is the same as no. 9, except that boiling was continued for 30 minutes, and examination on the 5th showed little difference in the fineness of the precipitate, though the clear liquid above was somewhat darker.

Wash 11. Prepared Ap. 4. This is the same as solution no. 9, except that boiling was continued for 50 minutes, and there was practically no difference to be discerned between this and solution no. 10.

Wash 12. Prepared Ap. 4. This is the same as solution no. 9, except that boiling was continued for one hour and 30 minutes, and there seems to be practically no difference in the appearance of this solution and no. 9 or its other modifications. These later boilings necessitate the addition of water sufficient to make up the loss by evaporation, but otherwise conditions were identical. There were no signs of crystallizing in other than washes 2, 3 and 4.

Field experiments with lime-sulfur washes 1904

Wash	Lime	Sulfur	Caustic soda	Sulfid of soda	Sal soda	Water	Length boil	Color
1	25 lb	20 lb				50 gal.	½ hr	Brick-red
2	25 lb	20 lb				50 gal.	1½ hr	Brick-red
3	25 lb	12 lb				50 gal.	½ hr	Red
4	25 lb	12 lb				50 gal.	1½ hr	Brick-red
5	30 lb	15 lb	4			50 gal.	Not any	Orange red
6	30 lb	15 lb	4			50 gal.	1 hr	Brick-red
7	30 lb	15 lb				50 gal.	1 hr	Brick-red
8	30 lb	15 lb				50 gal.	½ hr	Red
11	14 lb	6 lb		6 lb		50 gal.	15 min.	Gray green
12	14 lb	11 lb		11 lb		50 gal.	15 min.	Dark pea-green
14	25 lb	20 lb			12½ lb	50 gal.	15 min.	Brick-red
16	25 lb	20 lb			12½ lb	50 gal.	None	Brick-red
17	25 lb	20 lb			18 lb	50 gal.	None	Dark orange red

Field experiments with lime-sulfur washes

The experiments begun last year in a peach orchard at Warwick, were continued in 1904, owing to the fact that the trees were still rather uniformly infested with a small amount of scale and therefore presented almost ideal conditions for experimental work. The spraying began Ap. 13 but it was not completed till the 18th, owing to inclement weather, high winds and other adverse conditions. The 13th was a bright day and in the morning not much wind, but in the afternoon a stiff breeze rose and prevented spraying. The morning of the 14th there was a snow storm, and shortly after 9 o'clock spraying began but was stopped again at 11 on account of brisk winds. The following days were more or less unfavorable at times and as a consequence portions of the trees had to be resprayed. The preceding table gives most of the formulas employed and in brief the method of preparation together with other observations.

Wash 1 composed of 25 pounds of lime and 20 pounds of sulfur to 50 gallons of water, was boiled ½ hour. This wash, if well made, contains very little sediment. The water should be nearly boiling hot when the lime is added, the sulfur should follow the lime immediately, and it is necessary to agitate or stir vigorously and continuously till the lime is all slaked. A dark brick-red color is easily obtained within the allotted time. This wash was applied Ap. 13 to rows 8 and 9, and a second treatment given on the 15th in order to insure thoroughness.

July 22 no living scale insects were found on the treated rows and on Sep. 23 no living scale was observed on the foliage and very little on the trees.

Wash 2 is composed of 25 pounds of lime and 20 pounds of sulfur to 50 gallons of water, the lime being added to several pails of nearly boiling water, the sulfur put in at once, and boiling continued actively for 1½ hours. The long boiling appeared simply to deepen the brick-red color. This wash was applied April 13 to rows 2 and 3, and on account of the wind these rows were resprayed the 15th and thoroughly covered with the solution.

An examination July 22 resulted in discovering very few living scales. The trees were in a vigorous condition and the presence of the wash was quite evident. A further examination on Sep. 23, indicated that the application had been very successful, as no scale was seen on the foliage and very little on the trees.

Wash 3 composed of 25 pounds of lime and 12 pounds of sulfur to 50 gallons of water, was prepared in the same manner as wash 1

and the only difference observed between the two was a slightly lighter color as compared with wash 1. This wash was applied only to the lower end of rows 25 and 26.

July 22 no living scale insects were detected and the trees were vigorous and healthy. Sep. 23 very few living scale insects were observed; the treatment was fairly satisfactory.

Wash 4 composed of 25 pounds of lime and 12 pounds of sulfur to 50 gallons of water, was prepared in the same manner as wash 2, the boiling being continued an hour and a half. The only difference noticed was a slightly increased color. This mixture was applied to the lower ends of rows 27 and 28.

July 22 no living scale insects were found and the conditions were practically the same as those observed in the case of wash 3. Sep. 23 there were very few living scale insects, otherwise the treatment was fairly satisfactory.

Wash 5 composed of 30 pounds of lime, 15 pounds of sulfur and 4 pounds of caustic soda, was prepared by bringing 5 or 6 pails of water nearly to a boil. It was placed in a barrel, the lime added, followed at once by the caustic soda and sulfur in the order named. It was then thoroughly agitated with a hoe till chemical action had ceased sufficiently to permit of the barrel being covered with burlap. The reaction started slowly, at no time was it very violent, and less than two quarts of water was sufficient to keep it from overflowing. It was necessary to strain this compound twice before it could be sprayed, on account of the large amount of sediment. The color changed from orange to orange-red and the liquid after settling was an orange-red color; then came a sediment a little lighter than pea-green and at the bottom a deeper shade. This mixture, after stirring, appeared a brownish red color. The sediment was very gummy or sticky. This wash was applied Ap. 18, to rows 21 and 22.

July 22 no living scale insects were observed and the trees were vigorous and healthy. On Sep. 23 it was seen that this wash was very nearly the same as wash 8, there being a very small amount of living scale insects on the trees.

Wash 6 composed of 30 pounds of lime, 15 pounds of sulfur and 4 pounds of caustic soda, was practically a repetition of wash 5, except that it was boiled one hour, resulting in a little darker color. This mixture was applied Ap. 18 to rows 29 and 30.

July 22 no living scale insects were found on these rows and the conditions were practically the same as with washes 3 and 4. The trees appeared to be in excellent condition. Sep. 23 a very few

living scale insects were observed, otherwise the treatment was very satisfactory.

Wash 7 composed of 30 pounds of lime and 15 pounds of sulfur to 50 gallons of water, was prepared in the same way as wash 4, except that the boiling was continued for only an hour. No difference between the two was detected. It was applied Ap. 13 to rows 23 and 24.

July 22 small numbers of living scales were detected on the trees which were healthy and vigorous, and on Sep. 23 a very small amount of living scale was observed, otherwise the treatment was very satisfactory.

Wash 8 composed of 30 pounds of lime and 15 pounds of sulfur to 50 gallons of water, was boiled ½ hour. This wash was prepared the same way as wash 3 and there was no noticeable difference. It was applied to rows 19 and 20.

July 22 no living scale insects were found and on most of the trees, which were vigorous, the wash was still plainly visible. There was a small amount of living scale on two nearly dead trees which had not been previously treated. Sep. 23 it was seen that most of the trees were very clear of the scale, except a few rough barked ones, which probably sheltered some of the insects so they were not hit by the application.

Wash 9 composed of 1 pound of caustic soda to 6 gallons of water, was prepared by simply dissolving the caustic soda in a small amount of hot water, which was then diluted to the requisite quantity. It proved to be very caustic and whenever any of the spray fell on the hands or face, a stinging sensation was felt. This solution was applied Ap. 15 to rows 16 and 17, 7½ pounds of caustic soda being used to 45 gallons of water.

July 22 the trees treated with this solution were apparently quite vigorous, though there was more scale found on them than on those treated with wash 11. The check row, which stands next these two rows, was badly infested by scale insects and indications of breeding were abundant, the young being observed crawling on the limbs. The leaves on the check row were markedly smaller than those on the trees treated with this wash, and a number on the check row had turned color as if the trees were unable to support the foliage. An examination Sep. 23 showed that these trees were nearly as badly infested as those of the check row. This undoubtedly was due in part to spreading from the check row but at the same time there was abundant evidence showing that this solution has comparatively little value as a de-

stroyer of San José scale. Our object in experimenting with this mixture was simply to be in position to answer more definitely inquiries regarding this wash which, it may be remembered, was extensively boomed by certain agricultural papers last spring as one of the most effective applications for the destruction of San José scale. Experiments had been previously tried by others in different parts of the country, and the above results are simply confirmatory thereof.

Wash 10 was composed of two ounces of mercuric chlorid to 50 gallons of bordeaux mixture, the latter containing 5 to 8 pounds excess of lime. This wash was prepared by adding all the ingredients to boiling water, and while the chemical action seemed to be perfect it was difficult to strain. It was a dark slate color. This wash was applied Ap. 18 to 7 trees each on the upper end of rows 19 and 20.

July 22 there was a large number of living scale on the trees which, though not badly injured, showed less growth and were not as vigorous as others, and on Sep. 23 it was seen that these trees were only a very little better than the check row.

Wash 11 composed of 14 pounds of lime, 6 pounds of sulfur and 6 pounds of sulfid of soda, was prepared by bringing 5 or 6 pails of water nearly to a boil, the lime added, followed at once by the sulfur. The mixture was thoroughly stirred till the lime was slaked, then the sulfid put in, which latter operation was followed by further chemical action. Boiling was continued 30 minutes and a grayish green color obtained. This mixture was applied Ap. 15 to rows 14 and 15.

Observations July 22 resulted in finding some living scales on these trees, and this was confirmed Sep. 23, at which time a small number of young scale insects were observed on the foliage and young twigs, otherwise the results were as good as in the case of washes 1 and 2.

Wash 12 composed of 14 pounds of lime, 11 pounds of sulfur and 11 pounds of sulfid of soda to 50 gallons of water, was prepared on the afternoon of the 13th, but owing to trouble with the spray apparatus, was not applied till the following morning. There was very little crystallization though reheating was probably necessary. The wash was prepared by bringing 5 or 6 pails of water nearly to a boil, the lime was added, followed immediately by the sulfur. This was stirred thoroughly till the lime was slaked, then the sulfid was put in, which was followed by further chemical action. Boiling was continued for 30 minutes and the compound at this

time was a dark pea-green. There was greater chemical action than in the case of wash 11. This wash was applied Ap. 14 to rows 10 and 11, and a second treatment was given on the 15th in order to insure thoroughness.

July 22 no living scales were found nor any evidence whatever of breeding, and on Sep. 23 no living scale insects were seen on the foliage and very little on the trees, indicating that the treatment had been very successful.

Wash 14 composed of 25 pounds of lime, 20 pounds of sulfur and 12½ pounds of carbonate of soda to 50 gallons of water, was prepared by adding the lime, carbonate of soda and sulfur in the order named, to a few pails of almost boiling water in a small kettle, and then boiled 15 minutes. The chemical action was very violent and on account of the small size of the kettle some was lost by overflow in spite of repeated additions of cold water in an effort to keep the mixture within bounds. The compound changed rapidly in color from orange to brick-red and there was considerable sediment. The second lot was made in a larger kettle and the result was a more intimate combination and less than a teacupful of sediment. This wash was applied Ap. 13 to rows 4 and 5, and on account of the wind they were resprayed Ap. 15.

An examination July 22 resulted in finding no living scale insects on the treated trees, which were apparently vigorous and had made a growth of from 4 to 8 inches. These good results were confirmed by an investigation Sep. 23, when no young scale insects were seen on the foliage and very little on the trees.

Wash 16 composed of 25 pounds of lime, 20 pounds of sulfur and 12½ pounds of soda carbonate to 50 gallons of water, was prepared by placing 5 pails of water in a cask, and the lime, carbonate of soda and sulfur added in the order named. The mixture was continuously agitated with a hoe, and only 2 quarts of water were necessary to prevent it from boiling over. As soon as the action had ceased sufficiently, the barrel was covered with burlap and allowed to stand 30 minutes. There was very little sediment, less than a teacupful, and the combination appeared to be as perfect as in the case of wash 14. The color was a brick-red, about the same as in wash 14. This was applied Ap. 14, to rows 12 and 13, and a second treatment given the 15th.

July 22 no living scale insects were observed on the trees, which were vigorous and had made some growth, and Sep.23 no living scale insects were seen on the foliage and very little on the trees, indicating that the treatment had been a satisfactory one.

Wash 17 composed of 25 pounds of lime, 20 pounds of sulfur and 18 pounds of soda carbonate to 50 gallons of water, was prepared as follows: about 5 pails of water were brought to a boil and placed in a wooden barrel, and the lime, soda carbonate and sulfur added in the order named. The action was more violent than in the case of wash 16, and it was necessary to add cold water to the mixture three or four times in order to prevent overflowing. There was also a little more sediment and the color was darker, being a dark orange-red. This wash was applied Ap. 13 to rows 6 and 7, and a second treatment was given on the 15th on account of the windy weather the preceding day. On making up the wash a second time boiling hot water was employed as before and thorough stirring resulted in only a teacupful of sediment being left. It was allowed to stand in the barrel 45 minutes.

An examination July 22 resulted in finding no living scale on the trees and the presence of the wash was still evident. Sep. 23 no living scale was detected on the foliage and very little was found on the trees, indicating that the treatment had been very satisfactory.

Wash 18 composed of 1 pound of lime, 1 pound of soda carbonate to each 4 gallons of water, was prepared by adding the lime to a small amount of boiling water and then the carbonate of soda; stirring was continued till chemical action was completed. There was practically no sediment and the liquid possessed striking caustic properties, though it did not burn like wash 1. This preparation was applied Ap. 18 to the five uppermost trees on rows 14 and 15, and also to eight of the uppermost trees on rows 16 and 17.

July 22 it was found that there were a large number of living scale insects on these trees and breeding was quite apparent. Sep. 23 the condition of these trees was a very little better than the check row.

Observations. It will be seen by reference to the above records, that practically all of the lime-sulfur combinations reported on, were successful. In fact it was very difficult to detect any material difference between the various washes, and we are confident that a relative wide range in the proportions of the various substances is permissible, though undoubtedly one formula will gradually come into use on account of its efficiency and because of various economic considerations. We have decided, after a comparison of experiments and consultation with Prof. P. J. Parrott of the State Experiment Station at Geneva, to recommend a formula calling for 20 pounds of lime, 15 pounds of sulfur, no salt and at

least 30 minutes active boiling. This is very nearly the minimum amount of material which can be used safely, and we believe it hardly advisable to indorse the employment of a large amount of lime for the purpose of doing away with the necessity of boiling the mixture. Experiments with a caustic soda solution and with bordeaux mixture to which 2 ounces of corrosive sublimate were added, to 50 gallons, confirmed our belief in the comparative inefficacy of either of these washes. It may be remembered that this caustic soda wash was extensively advertised by certain agricultural papers, as one of the best methods of controlling the San José scale, in spite of the fact that earlier experiments by entomologists of good standing had shown that it was of comparatively little value. This material at best is a very caustic mixture and its employment under any circumstances, hardly advisable. One of the remarkable things about the matter was, that the wash was recommended by a party who appeared to have no standing, and as subsequent communications seemed to show very little idea of how the solution was actually made, yet his statements were accepted at face value and a great many, we fear, were induced to try this, and were probably greatly disappointed.

Last fall another method of preparing a lime-sulfur wash was extensively noticed in agricultural papers and is substantially as follows: make a paste of 20 pounds of sulfur with 2 gallons of boiling water and about 40 pounds of lime in a barrel, slaking the same with 12 gallons of boiling water, immediately adding the sulfur paste. Cover with an old blanket and allow it to cook 20 minutes, stirring occasionally with a garden hoe or other implement to keep the lime from settling, then dilute with warm water to 60 gallons and add 15 pounds of coarse salt, stirring a few minutes till it is dissolved. This method was brought to notice by Mr A. N. Brown of Delaware, who stated that the mixture gave excellent results and obviated the necessity of a prolonged boiling. This formula calls for the use of considerable boiling water and also for a large excess of lime, and while it may be efficient in most careful hands, we prefer, if boiling is dispensed with, to advocate the employment of either the sal soda lime-sulfur wash or the caustic soda wash. It is only fair to state that we observed a number of trees in Columbia county, which were treated last spring with a wash prepared as directed by Mr Brown, with fairly satisfactory results. The work was done by a very careful man who followed directions literally, and he probably obtained the best results possible. We also know of certain experiments which have

given fairly good results. We consider the large amount of lime employed disadvantageous because the excess appears to increase the tendency of the dried wash to scale off or peel.

A check row was left in this orchard in 1903, and in the spring of 1904, 18 of these trees were dead. The difference between them and others treated with various washes in 1903, was very striking. The insects bred rapidly during the latter end of the season of 1903 and consequently there were large numbers of scale insects, which evidently weakened the trees so that they were not able to survive the severe cold weather of last year. This was true not only of the trees on the check row, but also of some others on the western side of the orchard which had never been treated prior to 1904, and though they were sprayed in the course of our work last spring, our observations have been confined almost entirely to the trees which had been sprayed the previous year, because the badly infested ones which had not been treated were in about the same condition as those in the check row and consequently not adapted to experimental purposes.

It is interesting in this connection to place on record another instance of the value of the lime-sulfur wash in controlling peach leaf curl. In the Warwick orchard above mentioned, the different sprays were applied in rows running crosswise to the varieties, and it happened that the rows treated with the caustic potash solution included the last few trees of two rows of Elbertas, whereas all of the remainder were sprayed with one or the other of the various lime-sulfur combinations. The latter trees showed no indication of this disease throughout the season, whereas the Elbertas sprayed with the caustic potash solution were affected by this trouble to some extent, indicating that even if the caustic potash destroyed the scale, which our experiments show that it does not, the lime-sulfur wash is decidedly more valuable in checking the leaf curl.

Recommendations. Despite some evidence to the contrary, we believe that, for New York State at least, the best material for controlling the San José scale is a lime-sulfur wash provided it is properly made, and in this connection it is well to add that one can not be too careful in securing excellent lime because its quality has considerable to do with the efficiency of the wash.

Formulas

1
- 20 lb. of lime
- 15 lb. of flowers of sulfur
- 50 gal. of water; boil actively at least 30 minutes

2
- 20 lb. of lime
- 15 lb. of flowers of sulfur
- 4-6 lb. of caustic soda
- 50 gal. of water

3
- 20 lb. of lime
- 15 lb. of flowers of sulfur
- 10 lb. of sal soda
- 50 gal. of water

(1) This wash has been prepared very successfully by us, by simply slaking the lime in several pails of hot water in a kettle over a fire, adding the sulfur at once and continuing the boiling actively for at least 30 minutes, stirring at the outset till the lime had thoroughly slaked and the sulfur was moistened with the water, and repeating the stirring occasionally to prevent the material from caking on the bottom of the kettle. After 30 minutes boiling a deep brick-red color should be obtained. The mixture can then be dipped from the kettle and strained either through burlap or wire screening (ordinary mosquito netting will do), poured into the spray barrel and the necessary amount of cold water added to bring the whole up to 50 gallons. Some prefer to wet the sulfur with hot water before adding it, but in our experience this has been unnecessary.

(2) In making this wash the lime is slaked preferably with warm water, and while the reaction is in progress the sulfur, which has previously been made into a thin paste, is added and thoroughly mixed with the slaking lime. The caustic soda is then added and water supplied as needed, the whole being stirred thoroughly. After the chemical action has ceased, the mixture may be diluted to the requisite amount, preferably with hot water.

(3) This new wash may be prepared as follows: put 5 or 6 pails of hot water in a wooden barrel, preferably a thick pork or oil barrel, add the lime, quickly following that with the sulfur and sal soda, and stir actively till the slaking is practically completed. It may be necessary to add cold water at intervals to keep the mixture from boiling over. After the rapid bubbling or boiling is practically completed, cover the open barrel with burlap and

allow it to stand 30 minutes or more. This method of preparation gives an excellent compound so far as deep color and little sediment is concerned, provided it is properly prepared, and one of the essentials in making it, appears to be thorough stirring at the outset in order to intimately mix the lime, sal soda and sulfur. A deep red or even pea-green color should be secured if the material is well mixed. Strain and dilute with cold water to 50 gallons. This wash sprays nicely, and in the experiments commenced last spring, has given as good results in killing San José scale as any of the lime-sulfur washes. It has several advantages. It requires no boiling and the sal soda is a common material, easily handled and obtainable in almost every locality. It is also a little cheaper than the amount of caustic soda advised in preparing a similar quantity of wash. This material has been used but one season, and owing to its apparent merits we decided to put the formula in the hands of several of our associates. It was unfortunately sent out late, consequently not all could give it a thorough trial, but Professor Lochhead of the Ontario Agricultural College, states that in his hands it was just as successful as other lime-sulfur washes, and others obtained from good to excellent results in spite of their inability to give it a thorough trial. It is certainly a promising combination and one which should be tested more thoroughly another spring.

It would hardly be advisable to use either the caustic soda or sal soda washes just at present as fall sprays, since Professor Parrott of the State Agricultural Experiment Station at Geneva, has observed more twig injury where a caustic soda wash was used than where the ordinary boiled lime-sulfur wash was employed, and as our wash is practically a caustic soda wash (the caustic soda being obtained from the sal soda), it is advisable to be cautious about applying this material in the fall, though further experiments may show very little or no injury resulting from such treatment.

It is perhaps wise in this connection to reiterate the absolute necessity of thoroughness in treatment if the San José scale is to be controlled by spraying. Our best orchardists have found it advisable to take advantage of the wind so far as possible and wherever practical to go over the trees twice, the second time when the wind is in a different direction from what it was during the first treatment. Another factor which has perhaps not been duly emphasized, is the necessity of having good lime. It should be a lime that will slake vigorously, and the more heat generated,

the greater the likelihood of there being an intimate combination between the sulfur and the lime. Attention to minor details such as stirring, so as to prevent the lime and other chemicals forming comparatively inert masses at the bottom of the receptacle, is of considerable importance, since it is well known that the character of a chemical combination is materially affected by physical conditions. It is essential to mix these materials as intimately as possible and the difference between an efficient and comparatively useless wash may, in some cases, be attributed to variation in the method of preparation, even if the materials used be of the highest quality.

NOTES FOR THE YEAR

The following observations relate to the more important or interesting species brought to notice during the year.

Fruit tree insects

Fruit tree bark beetle (Scolytus rugulosus Ratz.) This rather common enemy of peach and plum trees in particular, has been the cause of several inquiries during the season of 1904, though in no instance has it been so injurious in New York State as it was a few years ago. It is a species which normally confines its attacks to diseased or dying trees, and only occasionally does it enter healthy ones. The infested branches should be cut off and burned as soon as discovered, in order to destroy the insects under the bark and prevent their spreading to other trees. Occasionally it may be possible to kill the borers under the bark by spraying the infested branches and trunk with crude petroleum, but such applications must be made with great care and, as a rule, they are not advisable.

Red-humped apple caterpillar (Schizura concinna Abb. & Sm.). This larva is one of our most striking caterpillars on account of its coral red head and the prominent hump of the same color on the first abdominal segment. The full grown caterpillar is about 1¼ inches long, black, with a series of rather conspicuous, yellowish, dorsal and sublateral lines, between which lie a series of white lateral lines. The full grown caterpillar bears prominent black tubercles on its body, they being specially well developed on the thoracic and first abdominal segments, on which latter they form conspicuous conical processes on the top of the swollen red portion of the segments described above. The moth is a rather inconspicuous creature with dark brown fore wings

grayish on the outer margin, a dot near the middle, a spot near each angle and several longitudinal streaks along the hind margin, all dark brown. The female deposits her eggs in clusters on the underside of leaves during the month of July; they hatch shortly, and the young caterpillars at first consume only the under surface of the leaf, leaving the upper unbroken, but as they increase in size the entire leaf is devoured. These interesting caterpillars are social in habit, remaining in rather compact groups when not feeding, and attain maturity in this latitude during August or early September. Their gregarious habit frequently results in one or more branches being entirely stripped. This species has but one brood in the North but in the South there are said to be two generations. It is seldom abundant and while displaying a marked preference for apple, also occurs on plum, cherry, rose, thorn and pear. Like other leaf-feeding species, this pest can be easily controlled by thorough spraying with an arsenical poison such as paris green, london purple or arsenate of lead, and in orchards where spraying is the rule, it very rarely causes trouble, particularly if the more adhesive arsenate of lead is employed.

Fall apple leaf miners. There are several species of small leaf miners which affect apple foliage in the fall, one of which makes a rather elongated mine on the under surface of the leaf, eating out the soft tissues completely, so that the upper surface presents a honeycombed or spotted appearance due to the veins and veinlets which are thicker than the upper epidermis. This species is found on appletrees during September and even in October and as late as early November. It has been termed the unspotted tentiform miner of the apple and is designated scientifically as Ornix geminatella Pack.

There is another leaf miner which works in apple foliage in a very similar way and at the same time, which is known as the spotted, tentiform miner, Lithocolletes blancardella Fabr. The work of this insect may be distinguished from the one mentioned above, by the spotted character of the upper surface of the mine caused by the small larva eating a little in one place and then moving to some other part of the mine to eat a little in another. This species transforms to the pupa within the mine, remaining there over winter, the moth emerging in the spring, while the larva of Ornix geminatella pupates in the edge of a turned up leaf, the adult appearing in the spring.

Still another species, the trumpet miner, Tischeria malifoliella Clem., occurs on apple leaves at this time,

making a trumpet-shaped mine which commences as a glistening spot where the egg was laid, continues for a short distance as a narrow line, gradually expanding and then suddenly widens into an irregular expanded portion. This mine is on the upper surface of the leaf and when old becomes a brown, trumpet-shaped area scarcely noticeable from the under surface. It is inhabited by a greenish, footless, active caterpillar. The upper and lower surface of the mine is densely lined with silvery white silk, making a winter retreat for the larva, which in the spring transforms to the pupa at one end of the mine and in a short time forces its way partly out through the upper surface of the mine and the moth appears. This is one of our common fall apple leaf miners and like the other two, rarely causes much injury because of its late appearance in the orchard.

All of these species appear on the foliage so late in the season that comparatively little injury is caused and, as a rule, no remedial measures are necessary. It is difficult in any event to control them by ordinary means, since the insects feed on the inner tissues of the foliage and consequently can not be reached by arsenical poisons or applications of contact insecticides. About the only way to destroy them, in case it is necessary, is to burn the fallen leaves which, as stated above, contain larvae or pupae and thus reduce the number of leaf miners another year.

Shade tree insects

Elm leaf beetle (Galerucella luteola Müll.). This species has been remarkable for its scarcity during the past season and the only thing worthy of special note is its establishment in considerable numbers in the village of Glens Falls. This is, so far as known to us, the northernmost locality where it occurs in abundance.

White marked tussock moth (Hemerocampa leucostigma Abb. & Sm.). This common and sometimes very destructive enemy of shade trees, has been present in small numbers on horse-chestnuts in particular, in the city of Buffalo, but in no instance have we known of its causing very serious injury. It is so easily controlled either by spraying or removing the conspicuous egg masses from the tree, that there is little excuse for allowing it to cause much damage.

Fall webworm (Hyphantria textor Harr.). This species was generally present in small numbers throughout the

State and, as a rule, did not cause damage enough to warrant repressive measures being adopted.

Woolly elm leaf louse (Schizoneura americana Riley). This woolly plant louse was met with in considerable numbers on the leaves of American elms at Saratoga Springs and Nassau. It frequently produces considerable deformity and curling of the foliage, the leaves sometimes forming large, irregular, distorted masses. In most cases single leaves are partly curled so that one side forms a cavity under the other half, the concavity being filled with plant lice and peculiar masses of powder-covered honeydew. The species was so abundant on some small trees, that the whitened particles of honeydew fell on foliage beneath and gave it the appearance of being spotted with a dilute whitewash. The growth of such infested trees is undoubtedly checked considerably.

Garden insects

Violet sawfly (Emphytus canadensis Kirby). This species is well known as a violet pest, and about the middle of June our attention was called to its depredations on pansies at Nassau. Investigations resulted in finding three or four of the dark colored larvae at the base of several plants. They had fed to such an extent that the pansies were unable to make a satisfactory growth. This species can undoubtedly be controlled by spraying the foliage with an arsenical poison, a proceeding hardly advisable in the case of most flowering plants. It is possible to find most of the sawfly larvae by digging about the roots of the plants, where they take refuge during the day, and this is probably the best method of checking the insect where the number of plants to be protected are relatively few.

Cucumber flea beetle (Crepidodera cucumeris Harr.). This minute, black, hopping flea beetle about $\frac{1}{16}$ inch long, is more or less abundant each year. Last season it appeared to be unusually numerous and inflicted considerable injury on tomato and potato plants, particularly on the latter, before the tomato plants had been set out. Thorough spraying with a poisoned bordeaux mixture is one of the most effective methods of controlling this species. Dusting the plants with plaster of paris, ashes etc., is of some value and is particularly to be recommended for tomato vines, specially after the fruit has begun to develop.

Stalk borer (Papaipema nitela Guen.). The work of this species is quite characteristic and has attracted consider-

able attention in different sections of the State on account of the injuries inflicted on tomatoes and corn in particular. The light brownish, white striped caterpillar works in the center of thick stalked plants and usually causes wilting followed by death of the portion above its burrow. It is a difficult species to control because the larva lives within the stems of plants and consequently can not be reached by arsenical poisons. About the only thing that can be done is to destroy the infested stalks with the contained larvae before they escape, wherever this is practical. Clean culture, particularly that resulting in the destruction of thick stalked plants growing in the vicinity of crops attacked by this insect, should result in reducing its numbers considerably.

Dark-sided cutworm (Agrotis messoria Harr.). This dingy colored, stout caterpillar about 1¼ inches in length, was the occasion of several complaints during the summer. It is a common frequenter of gardens and injures cabbages, potatoes, corn and various other plants. One of the simplest methods of controlling this pest is to examine the ground close to plants which have suffered from its attack; usually a little digging will disclose the depredator, and then it is only a moment's work to destroy the pest. Digging out by hand is somewhat laborious, and yet, if carefully done, is one of the most satisfactory methods of fighting cutworms. They may also be controlled to a considerable extent by the use of a poisoned bait, taking fresh clover or lettuce, dipping it in strong paris green water and then placing the same between or in the vicinity of infested plants. The cutworms are said to prefer this bait to growing plants. Sometimes it is possible to sow between rows, a little turnip or other seeds, so that the few cutworms will find abundant food in the secondary crop without destroying the one you wish to grow. They can also be killed by using a poisoned bran mash composed of paris green and bran or middlings, either mixed dry or enough water may be employed to make a soft mash. This material is very dangerous to have in gardens, particularly if chickens are kept.

Buffalo tree hopper (Ceresa bubalus Fabr.). This little species frequently causes more or less injury to small twigs of young trees and shrubs, but it is only occasionally that its injuries to herbaceous plants attract notice. Our attention was called by Dr O. C. Alexander of Albany, to the work of the nymphs of this insect. The young hoppers established themselves on the stems of the common balsam (Impatiens) and sucked the juices therefrom to such an extent that the plant was unable to support itself,

and the part above the point of injury lopped over and eventually died. An examination of young taken in the act, showed that it was very probably this species.

Pea louse (Nectarophora pisi Kalt.). Injuries by this species are more or less apparent from year to year and watchfulness for its appearance is advisable. This little enemy of the pea has caused considerable injury in recent years, and some knowledge of its life history and habits is a decided advantage in attempts so control it. It lives not only on ordinary garden peas, but also infests sweet peas, red and crimson clover, as well as vetches and tares. The insect hibernates on clover, particularly crimson clover, where that is grown, and probably on other food plants. The few overwintering individuals appear on peas, begin to multiply rapidly, and as the season advances become more and more abundant and cause a corresponding amount of injury. The above suggests that it is well to sow peas in fields rather distant from such leguminous plants as this species can live on, so as to delay the attack as much as possible. It also follows that early peas are much more exempt from injury than later varieties, and in sections where this pest is at all abundant, growers have largely abandoned the later kinds. This dreaded pest is controlled to a certain extent by a number of natural enemies, such as lady beetles, syrphid or flower flies, lace-winged flies, soldier beetles etc., but ordinarily these are not abundant enough to materially reduce the numbers of the pest. A fungus disease is sometimes a valuable aid, particularly in warm and humid weather. We would advise first, a growth, so far as possible, of early varieties away from other plants on which the species may winter, and secondly, good cultivation to hasten the development of the crop. Rotation is advisable, because a field in peas is likely to be infested the following year. In addition, it may be necessary at times to spray thoroughly with a contact insecticide such as the standard kerosene emulsion diluted with about 12 parts of water, or a whale oil soap solution. The latter, however, is said to be less efficient than the former. Spraying is expensive, and something may be accomplished by brushing the lice from the vines and then covering them with a cultivator. It might even be possible to devise an automatic brush, which could be attached just ahead of the cultivator, and thus, with no additional labor, bury many of the insects and at the same time cultivate the crop.

Miscellaneous

Owl beetle (Alaus oculatus Linn.). This is the largest of our native snapping beetles, measuring as it does from a little over 1 inch to 2½ inches in length. It is black, usually well sprinkled with irregular, white markings and may be recognized at once by the conspicuous white bordered, eyelike spots on the prothorax, markings which give the beetle its specific and common names. It is sometimes called the eyed elater. This species is brought to notice frequently with inquiry as to its life history and habits, and the following brief notes are appended for this reason.

The larva of this giant snapping beetle is about 2½ inches long, nearly ½ inch in breadth, flattened, reddish yellow in color, and is frequently found in decaying appletree wood. Formerly it was supposed to live on decaying wood. The late Dr Lugger in writing on this insect, makes the significant observation that all larvae he had reared would have perished had they not been provided with live insects which they soon found and devoured. If this be true, this species is not only interesting but decidedly beneficial. This beetle is a prominent representative of a very large family, all of which possess the power of projecting themselves suddenly into the air to a considerable hight, by the use of a peculiar apparatus on the ventral surface. A stout spine on the thorax extends back into a socket in the abdomen, and by bending its body the beetle can raise this spine and rest it on the edge of the socket and then, with a sudden muscular exertion, spring it back into the cavity. The result is that the beetle produces a peculiar snapping, rather startling sensation when held inverted in the hand, and smaller species belonging to this family are able to project themselves into the air to a hight several times their length. This is not true, however, of the form under consideration. This device has apparently no other use than to enable the beetle to regain its feet, as otherwise it is nearly helpless whenever it falls on its back.

Larder beetle (Dermestes lardarius Linn.). This oval, black beetle has been the cause of complaint in several instances, and may be easily distinguished by the rather broad, somewhat indistinct yellowish band on the anterior portion of the wing covers. It measures about .3 of an inch in length, and the brownish larva when full grown is about ½ inch long, dark brown and rather sparsely clothed with stiff, brownish hairs, which are as long or longer than the body. This species feeds mostly on dried animal matter of various kinds, such as bacon, dried meats and

hams, also on cheese, peltry, skins, horns, hoofs of dead animals, and even feathers, insects in museums, mounted birds and animals. It has also been recorded as devouring beeswax. It will not ordinarily eat clothing unless it is badly saturated with fatty animal matter. The most obvious method of protection from injury is to exclude the beetles from buildings where materials subject to attack are stored, and in case this is impractical, fumigation at intervals with carbon bisulfid should result in destroying most of these pests. An even more effective substance is hydrocyanic acid gas prepared by bringing diluted sulfuric acid in contact with cyanid of potassium. This latter material is exceedingly poisonous and should be handled only by those fully conversant with its nature. Neither the carbon bisulfid nor the hydrocyanic acid gas will injure skins, though we would not care to use the latter where dried meat was infested or any moist product likely to be used for food.

Cecidomyia hirtipes O. S. A very interesting solidago gall was found by the assistant entomologist, D. B. Young, at Elizabethtown N. Y., the later part of August. The outer portion closely resembled the partly open husks of a hickory nut, the inner cavity normally occupied by the nut being filled with a peculiar, stringy, fibrouslike growth, at the base of which dipterous pupae were observed. This curious deformation is evidently caused by the larvae attacking the plant early in its growth, and the tissues which would normally develop into a stout stem, become much thickened and form a somewhat globular gall which appears to rupture late in the season. A large fuscous, winged Cecidomyid was bred from this gall in early September, and on consulting literature it was found to be the species described by Osten Sacken under the above name. He states that it forms a rounded gall at the tip of stunted stalks of solidago, sometimes nearly an inch in diameter, smooth, brownish on the outside, solid inside, containing several larvae in compartments. It would seem from his description as though our split gall was something abnormal. The following description made from recently emerged individuals varies in slight particulars only, from that given by Osten Sacken.[1]

Description. Antennae yellowish, the apical eight or nine segments bright red, 22 segments in all, each with a basal whorl of dark brown hairs. Eyes black, rather coarsely granulated, deeply emarginate. Prothorax very narrow, black, with median area black, laterally reddish brown; mesothorax with a broad, median,

[1] Monogr. Diptera N. Am. pt 1, 1862, p. 195.

dark brown stripe, fuscous laterally and with equally broad, submedian stripes; anterior lateral portion reddish yellow. Scutellum pale reddish yellow, crowned with rather coarse, black hairs. Halteres: basal portion slightly yellowish, apical part trumpet-shaped, fuscous. Abdomen bright red, sparsely clothed dorsally with rather coarse, black hairs and with lateral patches of the same on each segment, giving the appearance of a broken, lateral row; ventral surface slightly lighter. Legs: anterior coxae reddish yellow, posterior reddish with irregular, fuscous markings; femora thickly clothed with black hairs, with some yellowish red. Tibiae entirely and tarsi partly clothed with jet-black hairs, the latter with a yellowish band near the distal portion of the first segment. Wings broad, thickly clothed with rather coarse, fuscous hairs; basal portion of costal vein almost black, subapical portion reddish, the same being true of the subcostal vein.

Length about $\frac{1}{4}$ of an inch.

Male similar to female, except that it is somewhat darker, the abdomen being more thickly clothed with long hairs, forming thicker, lateral tufts. Legs darker.

Beneficial insects

Chinese lady beetle (Chilocorus similis Rossi). A third shipment of these interesting little beetles was obtained last June, through the kindness of Prof. Wilmon Newell, state entomologist of Georgia, and established in a badly infested orchard at Kinderhook. Unfortunately we were unable to find larvae or signs of breeding, as had been the case with earlier shipments in the years of 1902 and 1903, and it is possible that most of the insects availed themselves of their freedom and spread to other trees. It is to be sincerely hoped that some of them have found conditions to their liking, bred freely, and that the species will become established in this section and prove of considerable service in controlling the San José scale insect. It certainly seems as though three introductions in successive years, would afford ample opportunities for these beetles to demonstrate their utility.

VOLUNTARY ENTOMOLOGIC SERVICE OF NEW YORK STATE

The work of the last five years has been continued by various observers in different sections of the State, and a number of valuable observations added to our previous records. The season of 1904 has been remarkable because of the comparatively small amount of

damage caused by the more common agricultural pests. Aside from the work of the striped cucumber beetle, the black flea beetle, the onion maggot, stalk borer and San José scale, there has been comparatively little injury to general agricultural crops. The season of 1903 was remarkable because of the unprecedented abundance of certain plant lice, particularly of species occurring on appletrees, and also on account of the extremely destructive work of the pear psylla (Psylla pyricola Forst.), a species which so seriously weakened thousands of trees in the Hudson river valley in particular, that they were unable to survive the unusually severe winter. These pests have hardly attracted the notice of agriculturists during the past season, and on referring to the following reports it will be observed that most of them are significant because of their negative character. Relatively few observers reported and those, as a rule, only at irregular intervals, indicating most clearly that insect depredations attracted comparatively little notice. The general sparsity of insect life may be attributed in part to the unusually severe winter, since the temperature went far below the normal on several occasions, and if it be true that insects can be frozen but once and survive, the severe weather of last winter was certainly sufficient to kill a very large proportion of the more exposed hibernating forms. The effect of winter on insect life is one of considerable importance, particularly if the future should demonstrate that a study of meteorological data would enable us to forecast with reasonable accuracy, the probability of severe injury by various insect pests. Such information can be acquired only through observations extending over a series of years and in various portions of the country, and it is gratifying to state that arrangements have already been made for such observations in New York and several of the New England states.

Cattaraugus county [C. E. Eldredge, Leon]—A small brown scale insect, the cherry scale (Lecanium cerasifex Fitch) has appeared in some numbers on peartrees but has not caused serious damage.—*May 31*

Cattaraugus county [F. A. Fitch, Randolph]—Last season the peartrees blighted very seriously (this probably refers to pear psylla attack, which was exceedingly common throughout the State). Tent caterpillar (Malacosoma americana Fabr.) nests are less numerous than usual at this time of the year. A few cabbage butterflies (Pieris rapae Linn.) have been observed.—*May 28.* Potato beetles (Doryphora 10-lineata Say) are quite numerous and mosquitos are in full force. Tent caterpillars

are scarce. Currant worms (Pteronus ribesii Scop.) have commenced operations, and black flea beetles (Crepidodera cucumeris Harr.) are at work on tomatoes. Scarcely any plum curculios (Conotrachelus nenuphar Hrbst.) have been observed. Cold, wet weather seems to have checked the development of insects. Many peartrees have blighted; this is probably due to their inability to withstand the severe winter after being badly injured by pear psylla (Psylla pyricola Forst.) the preceding year.—*June 18.* Striped cucumber beetles (Diabrotica vittata Fabr.) appeared in some numbers on squash vines.—*June 23.* Other insects have not attracted attention by their abundance.—*June 26.* Fall webworms (Hyphantria textor Harr.) have been much more abundant than usual. Cabbage butterflies are not as thick as they were last year. Other insects have not been abundant enough to cause trouble during the past season.—*Sep. 8*

Cayuga county [Purley Minturn, Locke]—A worm, probably a species of cutworm, has been eating cabbage plants off just at the top of the ground.—*July 8.* Apparently, insects are remarkably scarce in that section, as no other reports were received.

Genesee county [J. F. Rose, South Byron]—No complaints of canker worms (Paleacrita vernata Peck) have been received. Tent caterpillars (Malacosoma americana Fabr.) are very scarce. A long ride along highways fringed with wild cherries and bordered by many orchard trees, resulted in the discovery of only three nests. Rosebushes are as usual infested with plant lice. A few currant worms (Pteronus ribesii Scop.) have appeared and the currant stem sawfly (Janus integer Nort.) has begun its operations. A farmer reports plowing up potato beetles (Doryphora 10-lineata Say) in lively condition.—*May 31.* Striped cucumber beetles (Diabrotica vittata Fabr.) appeared first June 9 and became numerous the 12th. The first squash bugs (Anasa tristis DeGeer) were met with June 12. The cabbage stem maggots (Phorbia brassicae Bouché) are very destructive; they left only one out of 23 early cabbage plants, in spite of the fact that the plants were treated with fine salt. Cankerworms and tent caterpillars are not abundant. Potato bugs are numerous on early potatoes and some egg clusters have been deposited. There are very few plant lice on fruit trees.—*June 13.* Fall webworms (Hyphantria textor Harr.) were first observed July 2. Plant lice of various kinds continue scarce. We hear no com-

plaints of the pear psylla (Psylla pyricola Forst.) Striped cucumber beetles are numerous. The asparagus beetle (Crioceris asparagi Linn.) is not very plenty.—*July 14.* There has been far less than the usual number of potato beetles. Only one squash bug was observed. The second crop of fall webworms appears to be developing. A few plant lice (probably Megoura solani Thos.) were observed on potatoes. They appear to be quite numerous in some fields, and on account of the prevalence of potato blight, have had comparatively little opportunity to multiply.—*Sep. 14*

Greene county [O. Q. Flint, Athens]—The greatest insect injury noticeable hereabouts, is that to Bartlett peartrees, which was caused by the pear psylla (Psylla pyricola Forst.) last year. The trees were so weakened that many of them were unable to survive the winter. The injurious insects were much less numerous than usual at this time of year. Tent caterpillars (Malacosoma americana Fabr.) and elm leaf beetles (Galerucella luteola Müll.) are remarkably scarce, we having observed only one or two nests of the former, so far this spring.—*May 30.* The common pests are much scarcer than usual and climatic conditions have been generally unfavorable to the development of insect life. Pear psylla injury is the most evident of any insect damage, and as a result of last season's work, many orchards will be cut down. The pest has been somewhat abundant this summer, though most of the injury appears to have been inflicted the previous season. The elm leaf beetle has been much less numerous than for a number of years.—*Sep. 27*

Herkimer county [George S. Graves, Newport]—Tent caterpillars (Malacosoma americana Fabr.) nests were first observed May 16. Currant worms (Pteronus ribesii Scop.) are unusually abundant and abnormally early. The currant aphis (Myzus cerasi Fabr.) is rapidly increasing in numbers. The box elder is badly affected by a plant louse (Chaitophorus negundinis Thos.)—*May 26.* Potato beetles (Doryphora 10-lineata Say) were first noticed about May 15, and eggs were observed June 2. Black flea beetles (Crepidodera cucumeris Harr.) are attacking and perforating the potato leaves as fast as they appear above ground. Striped cucumber beetles (Diabrotica vittata Fabr.) were first observed June 7.

Young oyster shell scales (Lepidosaphes ulmi Linn.) were very abundant June 4.—*June 9.* A few wooly aphids (Schizoneura lanigera Haus.) were observed June 10 on appletrees, and the potato beetles were abundant June 11 for the

first time this season. Tomato foliage was badly riddled June 8 by the small, black flea beetle, and on the 12th turnip leaves were badly eaten by some insect (possibly the black-headed turnip worm, Evergestis rimosalis Guen.). Most fruit and shade trees are exceptionally free from insect pests.—*June 16.* The potato stalk borer (Papaipema nitela Guen.) is reported as causing considerable injury in fields about Canastota. Potato beetle grubs were observed June 20. Rose beetles (Macrodactylus subspinosus Fabr.) were observed on elm June 24, and a number of plant lice (probably Callipterus ulmifolii Mon.) were met with on the foliage. Currant worms are reported as exceedingly destructive and the hornfly (Haematobia serrata Rob.-Desv.) is said to be abundant. Cucumber leaves are somewhat skeletonized, probably by the striped cucumber beetle.—*June 25.* A second brood of currant worms is appearing in large numbers and a great many rose beetles are about. Potato beetles are not so plentiful as usual. A few potato beetle grubs were observed eating bean leaves that touched their normal food plant.—*July 1.* The rose leaf hopper (Typhlocyba rosae Harr.) has been causing some injury. Grasshoppers are relatively scarce and the plant lice on box-elder are not abundant.—*July 7.* The first nest of fall webworms (Hyphantria textor Harr.) was observed Aug. 1. Horn flies are not very numerous. Farmers claim that the depredations of the potato beetle have been unusually prolonged. The elm flea beetle (Disonycha triangularis Say) does not appear to be as destructive as usual.—*Aug. 4.* An unusual number of potato beetles were observed Aug. 12, in a highway adjacent to a potato field, probably deserting the field because of the unsatisfactory condition of the food plant. The elms have, after all, been seriously injured by the flea beetle. The work was probably later in the season or else not evident as early as usual.—*Sep. 28.* Nests of a peculiar tortricid (Thiodia signatana Clem.) were observed on the leaves of certain maples.—*Oct. 6*

Montgomery county [S. H. French, Amsterdam]—Insect pests of various kinds have attracted very little attention during the past season, the rose leaf hopper (Typhlocyba rosae Harr.) being the principal offender. We have found washing them off with a powerful stream of water from a hose, about as satisfactory as any method of control.—*May 23*

Orange county [J. M. Dolph, Port Jervis]—The potato stalk worm (Papaipema nitela Guen.) has been causing some injury in this section. Insect pests are scarcer than usual.—*June 27*

Dutchess county [H. D. Lewis, Annandale]—Cankerworms (Paleacrita vernata Peck.) are reported as being quite destructive in the northeastern portion of the county. The weather has been moderately dry and insects have not been abundant. Many peartrees injured last year by the pear psylla (Psylla pyricola Forst.) are dying, probably as a result of the injury combined with the excessive cold of last winter. Insect pests have been unusually scarce.—*July 25*

Orleans county [Virgil Bogue, Albion]—There has never been a time when there has been less injury from insect attack than the present. Colorado potato beetles (Doryphora 10-lineata Say) have hardly been seen till within the last few days and then only in very small numbers. Pear psylla (Psylla pyricola Forst.) and plant lice (Aphis mali Fabr.) which were so destructive last year, have not appeared this season. Cherries are comparatively free from worms (this is probably the cherry fruit fly, (Rhagolatis cingulata Loew.). Insect-eating birds have largely deserted us except the robins, and they looked lean and lank before the cherries commenced to ripen.—*July 3*

Queens county [C. L. Allen, Floral Park]—Pea aphids (Nectarophora pisi Kalt) appeared May 15, but have not been very destructive. Peartrees have not suffered from pear psylla (Psylla pyricola Forst.) or any other insect. San José scale (Aspidiotus perniciosus Comst.) appears to be on the increase. Potato beetles (Doryphora 10-lineata Say) have appeared in considerable numbers, and tent caterpillars (Malacosoma americana Fabr.) while present, are not very troublesome.

Richmond county [David Muirhead, West New Brighton]—Plant lice appeared on young peachtrees, plums, and on raspberry and blackberry shoots about May 20, and the webs of the grapevine plume moth (Oxyptilus periscelidactylus Fitch) appeared May 23, and seemed to be more abundant in sunny spots near the edge of a trellis. Larvae of the cabbage butterfly (Pieris rapae Linn.) were observed the same day and the butterflies are abundant.—*June 4*. Larvae of the 8-spotted forester (Alypia octomaculata Fabr.) appeared May 23, and the work of the tobacco thrips (Thrips tabaci Lind.) was observed June 6. The grape gall fly (Lasioptera vitis O. S.) is somewhat prevalent. White marked tussock moths (Hemerocampa leucostigma Abb. & Sm.) are present in small numbers. No larvae of the Colorada potato

beetle (Doryphora 10-lineata Say) have appeared. Tobacco thrips are causing considerable injury and cabbage butterfly larvae are fairly abundant. Caterpillars of the 8-spotted forester are rather rare, and the same is true of the swellings produced by the grape gall fly.—*June 11.* Colorado potato beetles were first observed June 12, and they do not appear to be at all numerous.—*June 18.* San José scale (Aspidiotus perniciosus Comst.) is rather abundant in this section and has caused a great deal of injury. Colorado potato beetles are not numerous and cabbage butterfly larvae are scarce. The tobacco thrips seems to have disappeared from cabbage and lettuce.—*June 25*

Rockland county [S. B. Huested, Blauvelt]—Pear psylla (Psylla pyricola Forst.) does not appear to be very abundant this year. Bartlett trees appear to have nearly all died, and though this may be due to neglect, the severe psylla injury of last year in connection with the unusually cold weather during the winter, is ample cause for most deaths. Plant lice have not appeared but tent caterpillars (Malacosoma americana Fabr.) have been abundant. Plant lice are much less numerous than last year.—*June 3*

Warren county [C. L. Williams, Glens Falls]—Pear psylla (Psylla pyricola Forst.) and plant lice were first observed in relatively small numbers in early June. June beetles (Lachnosterna sp.) have been much less abundant than last year. Cold weather seems to have delayed the appearance of rose beetles (Macrodactylus subspinosus Fabr.), as only an advanced scout or two has appeared up to date.—*June 6.* The rose beetles appeared 10 days later than last year and are not quite so destructive. The potato stalk borer (Papaipema nitela Guen.) is causing some damage in corn fields. Plant lice are increasing somewhat in numbers. Honeydew is very abundant on white elm, probably indicating many elm aphids (Callipterus ulmifolii Mon.). The elm leaf beetle (Galerucella luteola Müll.) has become well established in one or more quarters of the village. Rose beetles are not as abundant as last year.—*July 5.* Larvae of the elm leaf beetle are full grown and traveling on the tree trunks.—*July 19*

Westchester county [Frank R. Calkins, Ossining]—Black flea beetles (Crepidodera cucumeris Harr.) were first observed on tomato plants June 8, and on the 10th had eaten out large portions of the foliage. Larvae of the white marked tussock

moth (Hemerocampa leucostigma Abb. & Sm.) and black blister beetles (Epicauta pennsylvanica DeGeer) were observed in large numbers—*June 11.* This is rather early for the latter to be numerous. Several kinds of plant lice are more plentiful than last year, specially on hard maples. Elm leaf beetles (Galerucella luteola Müll.) are very numerous but their attacks are confined largely to the tops of the trees, many of which have the foliage skeletonized. Tent caterpillars (Malacosoma americana Fabr.) are plentiful, though not so abundant as last season. The onion fly (Phorbia ceparum Bouché) is causing considerable injury.—*June 13.* Cabbage butterflies (Pieris rapae Linn.) appeared in numbers for the first time June 20, and striped cucumber beetles (Diabrotica vittata Fabr.) June 25. Elm leaf beetles are increasing in numbers and destructiveness. The common house fly (Musca domestica Linn.) is not very common as yet. The 2-spotted lady beetle (Adalia bipunctata Linn.) is to be seen in some numbers.—*June 27*

Wyoming county (W. H. Roeper, Wyoming)—Tent caterpillars (Malacosoma americana Fabr.) appeared in some numbers for the first time May 20, they being less numerous than usual. The bud moth (Tmetocera ocellana Schiff.) is at work but not causing a great deal of damage. Cankerworms (Paleacrita vernata Peck) are at work in small numbers on apple-trees. The pear psylla (Psylla pyricola Forst.) has not appeared in destructive numbers as yet.—*June 13.* There have been very few insects present in sufficient numbers to cause an appreciable amount of damage.—*July 27*

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the entomologist during the year 1904. 67 are given with the title[1], place, time of publication and a summary of the contents of each. Volume and page number are separated by a colon, the first superior figure indicates the column, and the second the exact place in the column in ninths; e. g., 68:948[36] means volume 68, page 948, column 3, beginning in the sixth ninth, i. e. about two thirds of the way down.

Grapevine Root Worm. Grape Belt, Oct. 20, 1903, p. 1

Results obtained by collecting beetles and spraying for Fidia viticida Walsh. Value of poison for grapeberry moth, Polychrosis botrana Schiff.

[1]The titles are given as published, and in some instances they have been changed or supplied by the editors of the various papers.

Dust Sprays. Country Gentlemen, Nov. 5, 1903, 68:948[36]

Method of preparing dust spray and range of usefulness.

Mosquitos. Brooklyn Daily Eagle, Nov. 8, 1903, p. 12

Summary of recommendations for control.

Sprays for San José Scale. Country Gentleman, Nov. 12, 1903, 68:972[42]

Summary of results in 1903, with lime-sulfur wash, whale oil soap solution and crude petroleum against Aspidiotus perniciosus Comst.

Insects Affecting Forest Trees. For., Fish and Game Com. 7th Rep't 1901, p. 449–531, pl. 16.

Issued Nov. 1903. Also issued separately.

Accounts based on original observations are given of the following species:

Insects affecting the pine: turpentine bark beetle, Dendroctonus terebrans Oliv.; coarse writing bark beetle, Tomicus calligraphus Germ.; southern tomicus, Tomicus cacographus Lec.; pine bark beetle, Tomicus pini Say; Tomicus caelatus Eich.; Pityogenes species; Pityophthorus species; ribbed rhagium, Rhagium lineatum Oliv.; Pytho americanus Kirby; pine sawyer, Monohammus confusor Kirby; Xyloterus bivittatus Kirby; Gnathotrichus materiarius Fitch; white ants, Termes flavipes Kollar; white pine weevil, Pissodes strobi Peck; Pales weevil, Hylobius pales Herbst.; Magdalis perforata Horn.; Magdalis alutacea Lec.; pitch tip moth, Pinipestis zimmermani Grote; Nantucket pine moth, Retinia [Evetria] frustrana Scudd.; pitch pine Retinia, Retinia [Evetria] rigidana Fern.; pitch twig moth, Retinia [Evetria] comstockiana Fern.; pitch-inhabiting midge, Diplosis resinicola Osten-Sacken; pine bark Chermes, Chermes pinicorticis Fitch; spittle insects: Aphrophora saratogensis Fitch; Aphrophora parallela Say; Aphrophora quadrangularis Say; Le Conte's sawfly, Lophyrus lecontei Fitch; light-loving grapevine beetle, Anomala lucicola Fabr.; pine Chrysomela, Glyptoscelis pubescens Fabr.; imperial moth, Basilona imperialis Drury; pine leaf miner, Gelechia pinifoliella Chamb.; pitch-pine needle gall fly, Diplosis pini-rigidae Pack.; pine leaf scale insect, Chionaspis pinifoliae Fitch; Chrysobothris floricola Gory; Chrysobothris pusilla Bap. & Gory; Chrysobothris dentipes Germ.; pine flower cricket, Oecanthus pini Beut.

Insects affecting the spruce: destructive spruce bark borer, Polygraphus rufipennis Kirby; Cryphalus striatulus Mann.; Dryocoetes species; Xyloterus politus Say; Monarthrum mali Fitch.

Insects affecting the balsam: balsam bark borer, Tomicus balsameus Lec.; large black carpenter ant, Camponotus herculaneus Linn.

Insects affecting arbor vitae: Phlaeosinus dentatus Say.

Insects injurious to oaks: yellow striped oak caterpillar, Anisota senatoria Abb. & Sm.; buck or Maia moth, Hemileuca maia Drury; Cacoecia fervidana Clem.; Serica trociformis

Burm.; Stictocephala inermis Fabr.; Thelia acuminata Fabr.; Thelia monticola Fabr.; Telamona godingi Van Duz.; Archasia galeata Fabr.; two marked tree hopper, Enchenopa binotata Say; dog day cicada, Cicada tibicen Linn.; oak fig gall, Biorhiza forticornis Walsh; acorn weevil, Balaninus nasicus Say.

Lime-Sulfur Washes. Country Gentleman, Dec. 3, 1903, 68:1054[22]

Comments on methods of preparing wash without boiling, and criticisms of the so-called "lime-oil" wash.

Grapevine Root Worm [Fidia viticida Walsh]. N.Y. State Mus. Bul. 72. 1903. p. 1–51, 13 pl.

Issued Dec. 10, 1903. Republished largely in *Grape Belt*, p. 7, in issues for Feb. 9, 23, Mar. 8, 15, Ap. 5, 12, May 6, 17; also republished in part in *Jamestown Journal*, Feb. 10, 1904, p. 5.

Contents

	PAGE		PAGE
Preface	3	Varieties affected	30
Introduction	5	Grapeberry moth	31
Area infested	6	Natural enemies	32
Signs of insect's presence	6	Remedial measures	33
A native species	7	Destroying the pupae	33
Allies	8	Collecting beetles	34
Present conditions in Ohio	9	Arsenical poisons	39
Early history	11	Destruction of eggs	44
Description	13	Pulverizing the soil and mounding	45
Life history	15	Carbon bisulfid	45
Habits of the beetle	15	Kerosene emulsion	46
Eggs	19	Crude petroleum	46
Habits of the grubs or larvae	23	Calcium carbid	46
Pupa	25	Recommendations	47
Experimental work in 1903	26	Bibliography	47
Record of cage experiments	27	Explanation of plates	50
Insects taken by beetle catcher	29	Index	53
Food plants	30	Plates 1-6	face 52

Destroying Bees. Country Gentleman, Feb. 25, 1904, 59:176[43]

Carbon bisulfid advised for their destruction in a wall space.

Winter Insects in New York. Argus [Albany] Mar. 9, 1904, p. 4

Records taking a number of insects, beetles, flies, bugs and caterpillars in ice, the capture of Anopheles punctipennis Say on snow, and refers to other records of insects occurring in winter.

Insect Pests to Crops and Trees. Troy Record, Mar. 22, 1904, p. 5

Summary of losses caused by introduced insects, with notice of threatening species, a brief enumeration of injurious forms and reference to several recently introduced beneficial species.

Scale Insects. Mass. Fruit Growers Ass'n, 9th An. Meeting 1903, p. 24–31

Issued Mar. 1904. Discussion of remedies with special reference to crude petroleum emulsion and lime-sulfur wash for San José scale, Aspidiotus perniciosus Comst.

Appletree Bark Louse. Country Gentleman, Mar. 31, 1904, 69:296[42]

Identification and methods of controlling Lepidosaphes ulmi Linn.

New York State's Part in Mosquito Extermination. 1st Anti-Mosquito Convention Proc. 1903. 1904, p. 52–55

A brief summary of local conditions about New York city, with consideration of the advisability of the State undertaking investigations.

Recent Work upon the Grapevine Root Worm. Western N. Y. Hort. Soc. Proc. 1904, p. 48–51

Summary account of recent work against Fidia viticida Walsh; see Museum Bulletin 72 for details.

Appletree Bark Louse. Country Gentleman, Ap. 14, 1904, 69:345[12]

Identification and remedies for Lepidosaphes ulmi Linn.

Insects and Fungus. Country Gentleman, Ap. 14, 1904, 69:345[14]

San José scale, Aspidiotus perniciosus Comst., the fruit tree bark beetle, Scolytus rugulosus Ratz., other insects, and a quince fungus are briefly noticed.

Scale and Bark Louse. Country Gentleman, Ap. 14, 1904, 69:357[12]

Methods of controlling San José scale, Aspidiotus perniciosus Comst., with mention of the scurfy bark louse, Chionaspis furfura Fitch.

Pea Louse. Country Gentleman, Ap. 21, 1904, 69:369[17]

Methods of controlling Nectarophora pisi Kalt.

Cause and Control of Insect Depredations. Soc. Promotion Agric. Sci. Proc. 25th An. Meeting 1904, p. 73–83; also issued as a separate, Ap. 22

General discussion of methods of controlling insects and of insecticides employed.

A Quarter Century Record. Soc. Promotion Agric. Sci. Proc. 25th An. Meeting 1904, p. 84–90; issued as a separate, Ap. 22, also in Country Gentleman, June 2, 1904, 69:525

Brief résumé of progress in entomology in the past 25 years.

White Flower Cricket. Country Gentleman, Ap. 28, 1904, 69:392[23]

Identifies and characterizes injury by Oecanthus niveus DeG., and gives preventive measures.

Mosquitos as a Menace to Health. Albany Evening Journal, Ap. 28, 1904, p. 14

Brief general résumé of the importance of mosquitos and methods of controlling them.

Remedies for San José Scale. U. S. Dep't Agric. Div. Ent. Bul. 46, 1904, p. 52–54

Experiments with crude petroleum and lime-sulfur combinations in particular against Aspidiotus perniciosus Comst.

Observations in 1903. U. S. Dep't Agric. Div. Ent. Bul. 46, 1904, p. 65–69

Observations on apple aphids, Aphis mali Linn., cherry aphis, Myzus cerasi Fabr., Diplotaxus liberta Germ., codling moth, Carpocapsa pomonella Linn., pear psylla, Psylla pyricola Forst., San José scale, Aspidiotus perniciosus Comst., asparagus beetle, Criocerus asparagi Linn., cabbage maggot, Pegomyia brassicae Bouché., saw-toothed grain beetle, Silvanus surinamensis Linn., elm leaf beetle, Galerucella luteola Müll., and white marked tussock moth, Notolophus [Hemerocampa] leucostigma Abb. & Sm.

Wasps Disappearing. Country Gentleman, May 26, 1904, 69:489[22]

Probably local, species uncertain because of no description.

Pear Psylla. Country Gentleman, May 26, 1904, 69:492[26]

Note of warning and remedies for Psylla pyricola Forst.

Ants in Lawn. Country Gentleman, June 2, 1904, 69:512[23]

Methods of killing ants in their nests.

Wire Worms. Country Gentleman, June 2, 1904, 69:513[12]

Remedial measures for Drasterius elegans Fabr. in gardens, where it was eating seed potatoes.

Watch the Insect Pests. New York Farmer, May 26, 1904, p. 1

Requests information about pear psylla, Psylla pyricola Forst. and plant lice.

Monograph of the Genus Saperda. N. Y. State Mus. Bul. 74. 1904. p. 1–8, 14 pl. (7 col.) by E. P. Felt and L. H. Joutel.

Issued June 7.

Contents

	PAGE		PAGE
Preface	3	Saperda calcarata Say	39
Genus Saperda of Fabricius	4	tridentata Oliv	44
Subgeneric grouping	7	cretata Newm	50
Bibliography	9	discoidea Fabr	52
Distribution	9	vestita Say	54
Specific relationships	10	imitans n. sp	58
Systematic list of American species	13	lateralis Fabr	59
Key to species	15	fayi Bland	62
Grouping and summary of food habits of larvae	17	puncticollis Say	66
Saperda obliqua Say	18	populnea Linn	68
mutica Say	21	moesta Lec	71
hornii Joutel	22	concolor Lec	73
candida Fabr	23	Explanation of plates	76
		Plate 1–14	face 80
		Index	81

Blue-Banded Milliped. Country Gentleman, June 9, 1904, 69:537[13]

Identified, [remedies for Julus caeruleocinctus Wood.

New York Entomologic Service. Country Gentleman, June 9, 1904, 69:544[45]

Summaries of reports.

In the Chautauqua Grape Belt. Country Gentleman, June 9, 1904, 69:544[46]

Present conditions with observations on experimental work against the grape root worm, Fidia viticida Walsh.

Insect Depredations. Country Gentleman, June 9, 1904, 69:549, 573

Injuries due to devoting large areas to single crops, to improving plants for food and indirectly making them more attractive to insects, continuous growing of a crop on the same field. Methods of control are clean culture, rotation of crops, encouraging natural enemies. Several of the more important insecticides are briefly discussed under preventive measures, followed by a general summary.

Cultivation for the Destruction of Fidia. Grape Belt, June 14, 1904, p. 7

Advises cultivation shortly after the 13th or 14th on light soil for destruction of Fidia viticida Walsh.

Owl Beetle. Country Gentleman, June 16, 1904, 69:560[46]

Characteristics and habits of beetle and larva of Alaus oculatus Linn.

New York Entomologic Service. Country Gentleman, June 16, 1904, 69:561[27]

Summary of reports from voluntary observers.

Driving Away Bees. Country Gentleman, June 16, 1904, 69:571[22]

Methods of driving out and killing bees established in house walls.

New York Entomologic Service. Country Gentleman, June 23, 1904, 69:584[43]

Summary of reports.

Sugar Maple Borer. Country Gentleman, June 23, 1904, 69:597[41]

Remedial measures and observations on cutting out grubs of Plagionotus speciosus Say.

A Julus. Country Gentleman, June 23, 1904, 69:597[22]

Remedies for Julus caeruleocinctus Wood.

Time to Get Out Beetle Catchers. Grape Belt, June 28, 1904, p. 7

Advice relative to the operation of beetle catchers and spraying for Fidia viticida Walsh.

New York Entomologic Service. Country Gentleman, June 30, 1904, 69:606[45]

Summary of reports.

Importance of Laboratory and Field Work in Economic Entomology. Reprint from 17th An. Conv. Ass'n Am. Agric Coll. &Exp. Sta. Proc. U. S. Dep't Agric. Exp. Sta. Bul. 142

Observations on the importance of correlating and checking results by employing field as well as laboratory cages.

Record Devices. Reprint from An. Conv. Ass'n Agric. Coll. & Exp. Sta. Proc. U. S. Dep't Agric. Exp. Sta. Bul. 142

Describes an accession system and method of filing correspondence.

Elm Gall. Country Gentleman, July 7, 1904, 69:626[15]

Cockscomb elm gall, Colopha ulmicola Fitch, is identified and remedial measures indicated.

Cut Worms. Country Gentleman, July 7, 1904, 69:626[32]

Remedies for the dark sided cutworm, Paragrotis messoria Harr.

San José Scale. Country Gentleman, July 7, 1904, 69:626[35]

Summer treatment for Aspidiotus perniciosus Comst.

House Centipede. Hudson Register, July 14, 1904

Brief general account of Scutigera forceps Raf.

Cabbage Worms. Country Gentleman, July 21, 1904, 69:666[45]

Early use of arsenical poisons advised, supplemented later, where necessary by pyrethrum and hellebore.

A Sawyer. Country Gentleman, July 21, 1904, 69:667[11]

Brief popular notice of Monohammus confusor Kirby.

19th Report of the State Entomologist on Injurious and Other Insects of the State of New York 1903. N. Y. State Mus. Bul. 76.

Issued July 25, 1904

Contents

	PAGE
Introduction	91
General entomologic features	91
Office work	92
Special investigations	92
Publications	93
Collections of insects	94
Nursery inspection work	95
Voluntary observers	96
Acknowledgments	96
Beneficial insects	97
Synopsis of certain genera of the Ophionini	97
Injurious insects	125
Notes for the year	130
Plant lice	130
Fruit tree insects	137
Grapevine pests	142
Garden insects	143
Grain and house pests	145
Notes for the year (*continued*)	
Shade tree and forest insects	147
Beneficial insects	150
Experimental work against San José scale	151
Early spring or winter applications	151
Summer washes	159
Diseased and dying trees and insect attack	167
Voluntary entomologic service	173
List of publications of the entomologist	192
Insect exchange	200
Species received in exchange	201
Exchange list	207
Contributions to collection	213
Explanation of plates	221
Plates 1–4	face 222
Index	223

Larder Beetle. Country Gentleman, Aug. 4, 1904, 69:706[32]

Habits and methods of controlling Dermestes lardarius Linn.

Report of the Committee on Entomology. N. Y. State Fruit Growers Ass'n, 1904, p. 28–29

Summarized statement of experiments against San José scale, Aspidiotus perniciosus Comst., and the grape root worm, Fidia viticida Walsh.

Insect Pests of the Year. N. Y. State Fruit Growers Ass'n 1904, p. 136–39

General observations on plant lice, pear psylla, Psylla pyricola Forst., San José scale, Aspidiotus perniciosus Comst., and the grape root worm, Fidia viticida Walsh, with special reference to methods of control.

San José Scale in New York. Rural New Yorker, Aug. 6, 1904, 63:589[11]

Summary account of conditions and methods of controlling Aspidiotus perniciosus Comst.

Beetles-Lice. Country Gentleman, Aug. 18, 1904, 69:747[25]

Brief notice of spotted grapevine beetle, Pelidnota punctata Linn. with remedies for plant lice.

Carrion Beetles. Country Gentleman, Aug. 25, 1904, 69:769[12]

Identifies and gives habits of Necrophorus americanus Oliv.

Remedies for the San José Scale. The Canner & Dried Fruit Packer, Aug. 25, 1904, v. 19, no. 6, p. 32–34

Summarized account of methods of controlling Aspidiotus perniciosus Comst.

Importance of Isolated Rearings from Culicid Larvae by E. P. Felt & D. B. Young. Science 20:312–13

Describes Culex cinereoborealis, C. lazarensis, C. abserratus and C. fitchii.

Killing Ants. Country Gentleman, Sep. 8, 1904, 69:817[34]

Carbon bisulfid advised and method of application described.

Oak Potato Gall. Country Gentleman, Sep. 8, 1904, 69:817[36]

Gall and adult of Neuroterus batatus Fitch briefly described and remedy given.

False Caterpillar. Country Gentleman, Sep. 15, 1904, 69:841[16]

Brief general notice of Hylotoma pectoralis Leach on birch from Quebec.

Appletree Caterpillar. Country Gentleman, Sep. 15, 1904, 69:841[32]

Brief descriptive account of the red-humped apple caterpillar, Schizura concinna Abb. & Sm.

Hickory Leaf Gall. Country Gentleman, Sep. 29, 1904, 69: 887[23]

Brief descriptive notice of Cecidomyia persicoides O.S.

Fall Apple Leaf Miners. Country Gentleman, Oct. 13, 1904, 69:993[34]

Brief general accounts with remedial measures of the following: unspotted tentiform miner, Ornix geminatella Pack., spotted tentiform miner, Lithocolletes blancardella Fabr., and the trumpet miner, Tischeria malifoliella Clem.

Catalogue of the Entomologic Exhibit of the New York State Museum at the Pan-American Exposition. N. Y. at the Pan-Am. Exposition 1901–2, p. 273–354

Contents. Introductory, p. 273; Contents, p. 280; Fruit tree insects, p. 285; Vine and small fruit insects, p. 289; Garden insects, p. 291; Grass and grain insects, p. 295; Household insects, p. 297; Insects affecting stored food products, p. 300; Beneficial insects, p. 301; Scale insects, p. 304; Forest insects, p. 308; Shade tree insects, p. 312; Work of gall insects, p. 315; Bee and wasp family (Hymenoptera), p. 316; Beetles (Coleoptera), p. 320; 2-winged flies (Diptera), p. 330; Butterflies and moths (Lepidoptera), p. 333; Caddice flies (Trichoptera), p. 340; True bugs (Hemiptera), p. 341; Grasshoppers, locusts (Orthoptera), p. 343; Protective mimicry, p. 346; New York beauties, p. 347; Technical collection, p. 348; Framed photographs, p. 351; Winged frames, p. 351; Publications, p. 353.

CONTRIBUTIONS TO COLLECTION OCT. 16, 1903–OCT. 15, 1904

Hymenoptera

Megachile sp., leaf cutter bee, work on rose, Oct. 26, **O. Q. Flint,** Athens N.Y

Formica pennsylvanica DeG., black ant, work on spruce, Feb. 5, **William B. Young,** Lake Placid N. Y.

Neuroterus batatus Bass., oak potato gall on oak, Sep. 1, through *Country Gentleman*, Westport Mass.

Tremex columba Linn., pigeon tremex, adult on maple, Sep. 15, **J. E. Sanford,** Fredonia N. Y.

Harpiphorus tarsatus Say, larvae on Cornus, July 28, **F. E. Dawley,** Syracuse N. Y.

Coleoptera

Scolytus rugulosus Ratz., fruit tree bark beetle, work in plum, Ap. 8, **Helen Blydenburgh,** Smithtown L. I.

Madarus undulatus Say, Nov. 2, **J. R. de la Torre Bueno,** Van Cortlandt Park, N. Y.

Otiorhynchus sulcatus Fabr., adult on strawberry, June 24, **Thomas Cunningham,** Vancouver B. C.

O. ovatus, Linn, adult on strawberry, June 24, **Thomas Cunningham,** Vancouver B. C.

Hemantus floralis Linn., adult, Sep. 12, **Richard Lohrmann,** Herkimer N. Y.

Bruchus pisorum Linn., pea weevil, adults, Oct. 28, **Mrs Wendell Dorn,** Pattersonville N. Y.

Phyllotreta vittata Fabr., adult on radish, July 1, **G. S. Graves,** Newport N. Y.

Haltica ignita Ill., adult on elm, June 27, **G. S. Graves,** Newport N. Y.

Galerucella luteola Müll., elm leaf beetle, pupae and larvae on elm, July 19, **C. L. Williams,** Glens Falls N. Y.

Graphops pubescens Melsh., Nov. 2, **J. R. de la Torre Bueno,** Van Cortlandt Park N. Y.

Saperda populnea Linn., oviposition scars on twigs, July 25, **Dr L. Reh,** Hamburg, Germany.

Centrodera decolorata Harr., adult on beach, July 1, **G. S. Graves,** Newport N. Y.

Hylotrupes bajulus Linn., adult, June 28, **Helen R. Burns,** Yonkers N. Y.

Osmoderma scabra Beauv., adult on pear, June 15, **Mrs A. Lansing,** Albany N. Y.

Dorcus parallelus ? Say, larva on appletree, Oct. 17, **G. S. Graves,** Newport N. Y.

Sitodrepa panicea Linn., drug store beetle, adult, Aug. 24, **Warren L. Bradt,** Albany N. Y.

Drasterius elegans Fabr., larvae on potatoes, May, **C. B. Bassett,** Beerston N. Y.

Alaus oculatus Linn., owl beetle, adult, June 8, **J. Hannam Clark,** Cold Water N. Y.

Cryptophagus sp., beetles on dried, moldy squashes, Feb. 15, **C. H. Peck,** Menands N. Y.

Silvanus surinamensis Linn., saw-toothed grain beetle, adult in house, July 12, **R. D. Palmateer,** Waterford N. Y.

Necrophorus americanus Oliv., American carrion beetle, adult, Aug. 18, through *Country Gentleman,* Fair Haven N. J.

Lebia grandis Hentz., Nov. 2, **J. R. de la Torre Bueno,** Van Cortlandt Park N. Y.

List of larvae received from **Dr F. Meinert,** Copenhagen, Denmark. Dytiscidae: Hyphydous ovatus L., H. hyalinus DeG.? Laccophilus minutus Fabr.?, Cremidotus caesar Duftrchm., Haliplus ruficollis DeG., Ilybius fenestratus Fabr., Deronectes (Hydroporus) depressus Fabr.

Diptera]

Gastrophilus equi Fabr., horse bot fly, egg on hairs of a boa, May 3, **P. L. Huested,** Blauvelt N. Y.

Pegomyia vicina Lintn., beet leaf miner, larva on beet, June 28, **George T. Powell,** Lenox Mass.

Erax bastardii Macq., robber fly, adult, July 28, **J. E. West,** Poughkeepsie N.Y.

Culex melanurus Coq., larvae, **H. G. Dyar,** Washington D.C.

C. aurifer Coq., larvae and adults, **H. G. Dyar,** Washington D.C.

C. triseriatus Say, larvae, **H. G. Dyar,** Washington D.C.

C. dupreei Coq., larvae, **H. G. Dyar,** Washington D.C.

C. restuans Theo., larvae, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

C. sylvestris Theo., larvae, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

C. jamaicensis Theo., larvae, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

C. dyari Coq., larvae, **H. G. Dyar,** Washington D.C.

C. atropalpus Coq., larvae and adult, **H. G. Dyar,** Washington D.C.

C. discolor Coq., larvae, **H. G. Dyar,** Washington D.C.

C. sollicitans Walk., male and larvae, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

Theobaldia incidens Thomson, larvae, **H. G. Dyar,** Washington D.C.

Psorophora ciliata Fabr., adults and larva, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

Sciara ocellaris O. S., larvae on maple, June 4, **P. L. Huested,** Blauvelt N.Y.

Lasioptera vitis O. S., larvae on grape, June 8, **David Muirhead,** New Brighton N.Y.

Cecidomyia persicoides Clem., hickory leaf gall on hickory, Sep. 23, **A. Zabriskie,** Barrytown N.Y.

?Cecidomyia verrucicola O. S., adult on Tilia, July 23, **G. S. Graves,** Newport N.Y.

C. pellex O. S., larvae in ash galls, May 30, **O. Q. Flint,** Athens N. Y.

List of larvae received from **Dr F. Meinert,** Copenhagen, Denmark: Thalacrocera replicata L., Trichocera maculipennis Meig., Mochlonyx culiciformis DeG., Corethra plumicornis Fabr., Dixa aprilina Meig., Corethra pallida Fabr., Chironomus venustus Fries., Tanypus sp., Ceratopogon bipunctatum Gmel., C. circumdatum Staeg., Miastor metraloas Mein.

Siphonaptera

Ceratopsyllus serraticeps Gerv., cat and dog fleas, Aug. 16, **G. S. Kidder,** Port Henry N. Y.

Lepidoptera

Anosia plexippus Linn., adult on Asclepias, July 25, **Frances McCarty** Albany N. Y.

Sphecodina abbotii Swians, larva, July 5, **J. J. Smith,** Albany N. Y.

Phlegethontius quinquemaculata Haworth, Sep. 30, **H. O. Bassett,** Schenectady N.Y.

Ceratomia amyntor Hubn., hawk moth, caterpillar on elm. Aug. 16, **Mrs Abraham Lansing,** Albany N.Y.

Antherea yama-maia Guer., Japanese silk worms, larvae on scrub oak, May 31, **L. H. Joutel,** New York.

Philosamia cynthia Drury, Ailanthus worm, cocoon, June 10, **H. C. Hearman,** Lansingburg N.Y.

Tropaea luna Linn., luna moth, adult on walnut, June 14, **Rev. A. M. Kling,** Eminence N. Y.

Halisidota caryae Harr., hickory tussock moth, larvae, Aug. 12, **Raymond Watson,** Lockport N.Y.

Alypia octomaculata Fabr., 8-spotted forester, larva on grape, June 8, **David Muirhead,** New Brighton N.Y.

Agrotis messoria Harr., dark sided cutworm, larvae, June 3, **K. L. Palmatin,** Catskill N.Y. Same, June 28, **B. F. Haskell,** Portland Me.

Papaipema nitela Guen., stalk borer in tomato, June 28, **J. M. Dolph,** Port Jervis N.Y. Same in corn, June 29, **D. F. Meskil,** Highlands N.Y.

Schizura concinna Sm. & Abb., red-humped appletree caterpillar, larvae on apple, Sep. 7, **W. H. Gifford,** Onondaga county N.Y.

Malacosoma americana Fabr., tent caterpillar eggs on apple, Ap. 8, **Helen Blydenburgh,** Smithtown L.I.

Megalopyge opercularis Sm. & Abb., rabbit moth, cocoon on maple, Aug. 2, **Chester L. Whitaker,** Somerville Mass.

?Zeuzera pyrina Linn., leopard moth, work? on ?Norway maple, Nov. 24, **Ferdinand Fish,** Brooklyn N.Y.

Cossus centerensis Lint., larvae on Populus deltoides Marsh, July 26, **S. C. Bradt,** Albany N.Y.

Thiodia signatana Clem., on maple, Sep. 23, **Mrs Williamson,** Onteora N.Y.

?Gelechia obliquistrigella Chamb., red spruce bud worm, larvae on red spruce, Oct. 23, **C. R. Pettis,** Saranac Inn N.Y.

Lithocolletis hamadryadella Clem., oak leaf miner, larvae on oak, Aug. 8, **Mrs Isabella M. Banks,** New Hamburg N.Y.

Neuroptera

Corydalis cornuta Linn., hellgramite fly, adult, June 27, **Albert Spencer,** Albany N.Y.

Chaulioides pectinicornis Linn., comb-horned fish fly July 26, **O. Q. Flint,** Athens N.Y.

Hemiptera

Zaitha fluminea Say, waterbug, adult bearing egg mass, July 18, **O. Q. Flint,** Athens N.Y.

Lygus pratensis Linn., Nov. 2, **J. R. de la Torre Bueno,** Van-Cortlandt Park, N.Y.

Ceresa bubalus Fabr., Buffalo tree hopper on apple, Oct. 3, **Frank H. Knox,** Troy N.Y.

Smilia misella Lec., adult on San José scale, Nov. 24, **E. S. Miller,** Germantown N.Y.

Trioza tripunctata Fitch, bramble flea louse, adult on wild blackberry, Sep. 1, **Cyrus R. Crosby,** Penn Yan N.Y.

Pachypsylla celtidis-mamma Riley, jumping plant louse, gall on hackberry leaf, Celtis, Aug. 2, **O. Q. Flint,** Athens N.Y.

Phylloxera caryaecaulis Fitch, hickory gall aphis, galls on hickory, Ap. 6, **G. T. Powell,** Ridgefield Ct.

Schizoneura americana Riley, elm leaf woolly aphis, June 8, **F. W. Wells,** Saratoga Springs N.Y. Same, nymphs on elm, July 6, **A. T. Sutcliffe,** Chippewa Bay N.Y.

Pemphigus imbricator Fitch, on beech, Oct. 29, **G. S. Graves,** Newport N.Y.

Aleyrodes vaporariorum West., on fuchsia, Jan. 12, **Mrs W. H. Harrison,** Lebanon Springs N.Y.

Chermes pinicorticis Fitch, plant louse on balsam, Sep. 3, **John T. Sackett,** South Amenia N.Y.

Pulvinaria innumerabilis Rathv., on maple, June 30, through James H. Stoller [Schenectady N.Y.] Riverhead N.Y.

Lecanium? cerasifex Fitch, cherry Lecanium, adult on pear, May 31, **C. E. Eldridge,** Leon N.Y.

Coccus hesperidum Linn., house Lecanium, adults on fern, Mar. 18, **Mrs E. H. Mairs,** Irvington N.Y.

Eulecanium nigrofasciatum Perg. on maple, Nov. 25, **P. L. Huested,** Highland Falls N.Y.

E. tulipiferae Cook, tulip scale, young on tulip, Feb. 15, **P. L. Huested,** Milton N.Y. Same, adult on tulip, July 9, **Truman H. Baldwin,** Nyack N.Y.

Chionaspis corni Cooley, adults on Cornus sanguinea Feb. 6. **B. D. VanBuren,** Geneva N.Y. Same, adult on Cornus, Feb. 23, **Thos. Cunningham,** Vancouver B.C.

C. pinifoliae Fitch, pine leaf scale insect on pine, Dec. 9, **G. L. Flanders,** Rochester N.Y. Same, on pine, Oct. 12, **G. G. Atwood,** Albany N.Y.

C. furfura Fitch, scurfy bark louse on crab apple, Ap. 6, **J. O. Carleton,** New York city.

Chrysomphalus aonidum Linn., adults on rubber plant, Dec. 7, **C. H. Peck,** Menands N.Y.

Aulacaspis pentagona Targ., West Indian peach scale on flowering cherry, Ap. 28, **T. F. Niles,** Chatham N.Y.

A. rosae Bouché, rose scale, adult on blackberry, Dec. 14, **Ohio State Dep't Agric.**

Aspidiotus ancylus Putn., Putnam's scale insect, adults on Cornus florida, Dec. 12, **N. Y. State Dep't Agric.,** Flushing N.Y.

A. forbesi Johnson, cherry scale on pear?, Ap. 16, **Fred T. Wiley,** Geneva N.Y.

A. perniciosus Comst., San José scale, adults, on crab apple, Ap. 6, **J. O. Carleton,** New York city. Same on currant, Ap. 8, **Helen Blydenburgh,** Smithtown Branch L.I. Same on currant, Ap. 20, **S. B. Huested,** Blauvelt N.Y. Same on Japan weeping cherry, imported directly from Japan, Ap. 23, **G. G. Atwood.** Same on apple, peach, currant and laburnum, May 13, **Miss M. J. Tyers,** Dobbs Ferry N.Y. Same on peach, May 21, **S. F. Skidmore,** East Hampton L.I. Same, June 28, **H. Steers,** Larchmont N.Y. Same, all stages on crab apple, July 11, **David Muirhead,** West New Brighton N.Y. Same on currant, July 15, **G. T. Powell,** Ghent N.Y. Same, all stages on pear, Aug. 1, **David Muirhead,** West New Brighton N.Y. Same, all stages on pear, Aug. 5, **Mrs Edwin H. Mairs,** Irvington N.Y. Same, on plum, Sep. 17, **Myron S. Wheeler,** Berlin Mass.

Lepidosaphes ulmi Linn., appletree bark louse, eggs on silver maple, Ap. 9, through **Country Gentleman,** Wallkill N.Y. Same, on horsechestnut, Ap. 22, **T. L. Memikheim,** New Dorp N.Y. Same on willow, June 2, **J. W. Hand,** Easthampton L.I. Same on apple, Sep. 15, **E. Spaulding,** Greenville N.Y.

List of Ohio Coccidae received from **Mr J. G. Sanders** of the Ohio State University, Columbus O., June 13, 1904: Chionaspis corni Cooley, on Cornus amomum, June 30, 1903, at Cedar Point, Erie co., O.; C. pinifoliae (Fitch), on Pinus strobus and P. virginiana,

Mar. 2, 1903, at Columbus O.; C. gleditsiae Sanders (Cotypes) on Gleditsia triacanthos, Mar. 11, 1903, at Columbus O.; C. longiloba Cooley, on Populus deltoides (cottonwood) Ap. 14, 1904, at Painesville O.; C. salicis-nigrae Walsh, on Salix sp., May 10, 1903, at Columbus O.; C. americana Johns., on Ulmus americana, Feb. 16, 1904, at Columbus O.; Chrysomphalus obscurus Comst., on Quercus alba, Mar. 15, 1904, at Columbus O.; Aspidiotus juglans-regiae Comst., on Tilia americana, Ap. 4, 1904, at Columbus O.; Aspidiotus piceus Sanders, (Cotypes) on Liriodendron tulipifera, July 7, 1903, at Painesville, Lake co., O.; Eulecanium fletcheri Ckll., on Juniperus virgiana, Oct. 14, 1903, at Columbus O.

Orthoptera

Oecanthus niveus DeG., white flower cricket, eggs on plum, Ap. 20, **W. L. Martin,** Middlebrook Va.

Hippiscus tuberculatus Beauv., coral-winged locust, nymph on snow, Mar. 16, **H. A. Van Fredenberg,** Port Jervis N.Y.

Diapheromera femorata Say, walking stick, adult, Aug. 17, **Miss Grace Smith,** Albany N.Y. Same, adult, Sep. 26, **Miss Rhoda Thompson,** Ballston Spa N.Y.

Tenodera sinensis, Chinese mantis, adult on grapevine, Nov. 19, **F. W. Hopper** Philadelphia Pa.

Ephemeridae

Palingenia bilineata Say, May fly, adult, July 28, **J. E. West,** Poughkeepsie N.Y.

Trichoptera

Hydropsyche morosa Hag., caddice fly, adult, June 14, **Miss M. B. Sherman,** Ogdensburg N.Y.

Acarina

Phytoptus acericola Garm., gall mite, gall on sugar maple, July 12, **Edwin Buchman,** Valley Falls N.Y.

P. abnormis Garm., gall mite, adult on linden, July 23, **G. S. Graves,** Newport N.Y.

Myriapoda

Scutigera forceps Raf., house centipede, Nov. 21, **J. N. Dolph,** Port Jervis N.Y.

Julus caeruleocinctus Wood, blue-banded milliped, Oct. 17, **G. S. Graves,** Newport N.Y. Same, June 2, **T. A. Cole,** Madison county.

APPENDIX

INSECT EXHIBIT AT THE LOUISIANA PURCHASE EXPOSITION

The office supervised the preparation of a small collection of insects which was exhibited by the Forest, Fish and Game Commission, in the New York section of the Forestry Building and

was awarded a silver medal in group 112. This collection was designed to show the life history and habits in particular of the more injurious species affecting valuable forest trees, and one tray was given to characteristic insects of the Adirondacks. Special effort was made to depict, so far as possible the life history, habits and methods of work of those forms of economic importance and to show whenever practicable the natural enemies of value in keeping these species in control. A brief catalogue of the exhibit is given below.

CATALOGUE

Insect galls

This collection, occupying two nearly perpendicular trays and representing the work of 53 species, was devoted to the peculiar vegetable deformities produced by insects, since these forms are always of great popular interest.

Galls of sawflies

Tenthredinidae

1 **Willow apple gall**
Pontania pomum Walsh

4-winged gall flies
Cynipidae

2 **Spiny bullet gall**
Rhodites bicolor Harr.

3 **Mealy rose gall**
Rhodites ignota O.S.

4 **Rose root gall**
Rhodites radicum O. S.

5 **Spiny rose gall**
Rhodites spinosa Ashm.

6 **Seedy blackberry gall**
Diastrophus cuscutaeformis O. S.

7 **Furrowed blackberry gall**
Diastrophus nebulosus O. S.

8 **Oak apple**
Amphibolips confluentus Harr.

9 **Larger empty oak apple**
Amphibolips inanis O. S.

10 **Scrub oak gall**
Amphibolips ilicifoliae Bass.

11 **Oak plum gall**
Amphibolips prunus Walsh

12 **Horned oak gall**
Andricus ?cornigerus O. S.

13 **Gall of wool sower**
Andricus seminator Harr.

14 **White oak club gall**
Andricus clavula Bass.

15 **Small oak apple**
Andricus singularis Bass.

16 **Oak petiole gall**
Andricus petiolicola Bass.

17 **Oak-woolly gall**
Andricus lana Fitch.

18 **Woolly oak gall**
Andricus operator O. S.

19 **Gouty oak gall**
Andricus punctatus Bass.

20 **Spiny oak gall**
Cynips prinoides Beutm.

21 **Pine cone gall**
Cynips strobilana O. S.
22 **Oak leaf seed gall**
Cynips decidua Bass.
23 **Oak hedgehog gall**
Acraspis erinacei Walsh
24 **Oak fig gall**
Biorhiza forticornis Walsh
25 **Hairy oak leaf gall**
Biorhiza hirta Bass.
26 **Oak bullet gall**
Holcaspis globulus Fitch
27 **Rough bullet gall**
Holcaspis duricoria Bass.
28 **Oak leaf bullet gall**
Dryophanta polita Bass.
29 **Oak potato gall**
Neuroterus batatus Fitch.
30 **Oak button gall**
Neuroterus umbilicatus Bass.
31 **Noxious oak gall**
Neuroterus noxiosus Bass.
32 **Leaf oak gall**
Cynips ?frondosa Bass.
33 **Blueberry gall**
Solenozopheria vaccinii Ashm.

TWO-WINGED GALL FLIES

Diptera

34 **Hickory onion gall**
Cecidomyia holotricha O. S.
35 **Hickory pill gall**
Cecidomyia persicoides O. S.
36 **Willow cone gall**
Cecidomyia strobiloides O. S.
37 **Oak pill gall**
Cecidomyia pilulae Walsh.
38 **Balsam leaf gall**
Cecidomyia balsamicola Lintn.
39 **Willow twig gall**
Rhabdophaga salicis Schrk.
40 **Small solidago gall**
Trypeta polita Loew.
41 **Large solidago gall**
Trypeta solidaginis Fitch

TRUE BUGS

Hemiptera

Psyllid galls

Psyllidae

42 **Hackberry nipple gall**
Pachypsylla celtidis-mamma Riley

Galls of plant lice

Aphididae

43 **Witch-hazel cone gall**
Hormaphis hamamelidis Fitch
44 **Spiny witch-hazel gall**
Hormaphis spinosus Shimer
45 **Cockscomb elm gall**
Colopha ulmicola Fitch
46 **Poplar leaf stem gall**
Pemphigus populitransversus Riley
47 **Basal leaf gall**
Pemphigus populicaulis Fitch
48 **Vagabond gall**
Pemphigus vagabundus Walsh
49 **Phylloxera galls**
Phylloxera vitifoliae Fitch
50 **Hickory stem gall**
Pemphigus caryaecaulis Fitch

51 Larch aphid gall
Chermes abietis Linn.

MITES

Acarina

Gall mites

Phytoptidae

52 Fusiform maple gall
Phytoptus acericola Garman

53 Linden mite gall
Phytoptus abnormis Garman

Forest insects

The species affecting forest trees in particular, are numbered 54 to 97 inclusive and were contained in three horizontal trays, occupying one side of the case. This section was devoted principally to representing the biology of the members of this important group and to displaying the work of various forms.

54 Large black ant
Camponotus pennsylvanicus Cress.

Specimen from heart of dead spruce, cut by William B. Young, on east shore of Lake Placid, Dec. 1903; 187 rings were counted and the tree was probably over 225 years old.

55 Large carpenter bee
Xylocopa virginica Drury.

Wood borers

56 Xiphydria provancheri Cr.

57 Pitch pine twig tortrix
Retinia comstockiana Fern.

58 Pitch tip moth
Pinipestis zimmermani Grote

59 Bronze birch borer
Agrilus anxius Gory.

90 Blue pine borer
Callidium antennatum Newm.

61 Maple tree pruner
Elaphidion villosum Fabr.

62 Obrium rubrum Newm.

63 Painted hickory borer
Cyllene pictus Drury.

64 Locust borer
Cyllene robiniae Forst.

65 Common oak clytus
Xylotrechus colonus Fabr.

66 Neoclytus erythrocephalus Fabr. (Associated species)

67 Tomoxia bidentata Say (Associated species)

68 Ribbed rhagium
Rhagium lineatum Oliv.

69 Pytho americanus Kirby

70 Pine sawyer
Monohammus confusor Kirby

71 Pine sawyer
Monohammus scutellatus Say

72 Tickler
Monohammus titillator Fabr.

73 White pine weevil
Pissodes strobi Peck

74 Willow snout beetle
Cryptorhynchus lapathi Linn.

Bark and wood borers

Scolytids

75 Monarthrum mali Fitch

76 Gnathotrichus materiarius Fitch

77 Pityogenes sp.

78 Pityogenes sp.
79 Pityogenes sp.
80 Pityogenes consimilis Lec.
81 Pityophthorus minutissimus Zimm.
82 Pityophthorus sp.
83 Xyloterus politus Say
84 Xyloterus bivittatus Kirby
85 Cryphalus striatulus Mann.
86 Dryocoetes eichhoffi Hopk.
87 Dryocoetes sp.
88 Xylocleptes sp.
89 Tomicus calligraphus Germ.
90 Tomicus cacographus Lec.
91 Tomicus pini Say
92 **Balsam bark beetle** Tomicus balsameus Lec.
93 Tomicus caelatus Eich.
94 Scolytus quadrispinosus Say.
95 **Spruce bark beetle** Polygraphus rufipennis Kirby
96 Phloeosinus dentatus Say
97 **Turpentine beetle** Dendroctonus terebrans Oliv.

Shade tree insects

It is difficult to draw a sharp distinction betwen forms affecting forests and those depredating on our shade trees. Some insects, hardly injurious in the forests, are very destructive to shade trees and on that account it has been deemed advisable to exhibit some of these species and their allies under one head. Like that representing forest insects, the exhibit of shade tree pests is very largely biologic and was represented by numbers 98 to 140, occupying three horizontal trays and a nearly vertical one of the exhibit case.

98 **Pigeon tremex** Tremex columba Linn.
99 **Lunate longsting** Thalessa lunator Fabr.
100 **Maple tree borer** Plagionotus speciosus Say
101 **Poplar borer** Saperda calcarata Say
102 **Elm bark borer** Saperda tridentata Oliv.
103 **Elm snout beetle** Magdalis barbita Say
104 **Dark elm bark borer** Hylesinus opaculus Lec.
105 **Carpenter moth** Prionoxystus robiniae Peck
106 **Leopard moth** Zeuzera pyrina Fabr.
107 **17 year cicada** Cicada septendecim Linn.

Leaf feeders

108 **American sawfly** Cimbex americana Leach
109 **Mourning cloak** Euvanessa antiopa Linn.
110 **Elm leaf beetle** Galerucella luteola Müll.
111 **Spined soldier bug** Podisus maculiventris Say (Enemy of above)
112 **Four-horned sphinx** Ceratomia amyntor Geyer
113 **Cecropia moth** Samia cecropia Linn.

114 Promethea moth
Callosamia promethea Drury
115 Imperial moth
Basilona imperialis Drury
116 Fall webworm
Hyphantria cunea Drury
117 Hickory tussock moth
Halisiodota caryae Harr.
118 White marked tussock moth
Notolophus leucostigma Abb. & Sm.
119 Pimpla conquisitor Say (Natural enemy)
120 Tachina mella Walk. (Natural enemy)
121 Bagworm
Thyridopteryx ephemeraeformis Haw.
122 Birch leaf Bucculatrix
Bucculatrix canadensisella Chamb.
123 Cottonwood leaf beetle
Lina scripta Fabr.
124 Ocellate red-spot
Sciara ocellaris O. S.
125 Catalpa cecidomyid
Cecidomyia sp.
126 Birch aphid
Callipterus betulaecolens Fitch
127 Larch sawfly
Lygaeonematus erichsonii Hartig.
128 Leconte sawfly
Lophyrus lecontei Fitch
129 Fir sawfly
Lophyrus abietis Harr.
130 Pitch-inhabiting midge
Diplosis resinicola O. S.
131 Pine tube builder
Eulia politana Haw.
132 Luna moth
Tropaea luna Linn.
133 Buck or maia moth
Hemileuca maia Drury
134 Yellow striped oak caterpillar
Anisota senatoria Abb. & Sm.
135 Oak webworm
Archips fervidana Clem.
136 Forest tent caterpillar
Malacosoma disstria Hübn.
137 Pimpla conquisitor Say (Natural enemy)
138 Pteromalus vanessae How. (Natural enemy)
139 Theronia fulvescens Cress.
140 Tachina mella Walk.

Adirondack insects

This is a small collection occupying one of the nearly perpendicular trays and composed of over 100 species; namely, numbers 141 to 245. This portion of the exhibit, as will be seen by the list appended below, represents the more characteristic forms of the various orders.

BEETLES

Coleoptera

141 Cicindela 6-guttata Fabr.
142 Alaus oculatus Linn.
143 Corymbites vernalis Hentz.
144 Chalcophora fortis Lec.
145 Dicerca divaricata Say
146 Buprestis maculiventris Say

147 Melanophila fulvoguttata Harr.
148 Chrysobothris femorata Fabr.
149 Calopteron reticulatum Fabr.
150 Ellychnia corrusca Linn.
151 Dorcus parallelus Say
152 Ceruchus piceus Web.
153 Passalus cornutus Fabr.
154 Copris anaglypticus Say
155 Aphodius fimetarius Linn.
156 Geotrupes egeriei Germ.
157 Pelidnota punctata Linn.
158 Eurphoria inda Linn.
159 Osmoderma scabra Beauv.
160 Trichius affinis Gory
161 Dichelonycha elongata Fabr.
162 Parandra brunnea Fabr.
163 Orthosoma brunneum Forst.
164 Prionus laticollis Drury
165 Phymatodes dimidiatus Kirby
166 Clytanthus ruricola Oliv.
167 Cyrtophorus verrucosus Oliv.
168 Desmocerus palliatus Forst.
169 Leptura canadensis Newm.
170 Leptura proxima Say
171 Leptura vittata Germ.
172 Saperda vestita Say
173 Chrysomela bigsbyana Kirby
174 Cratoparis lunatus Fabr.

BUTTERFLIES AND MOTHS

Lepidoptera

175 Anosia plexippus Linn.
176 Argynnis aphrodite Fabr.
177 Brenthis bellona Fabr.
178 Polygonia interrogatonis Fabr.
umbrosa Lintn.
179 Polygonia faunus Edw.
180 Eugonia j-album Boisd. & Lec.
181 Vanessa atalanta Linn.
182 Basilarchia arthemis Drury
183 Basilarchia archippus Cram.
184 Cyaniris ladon Cram.
185 Pontia rapae Linn.
186 Eurymus philodice Godart.
187 Papilio turnus Linn.
188 Papilio troilus Linn.
189 Smerinthus jamaicensis Dru.
190 Paonias excaecatus Sm. & Abb.
191 Ceratomia undulosa Walk.
192 Marumba modesta Harr.
193 Ctenucha virginica Charp.
194 Automeris io Fabr.
195 Anisota rubicunda Fabr.
196 Estigmene acraea Dru.
197 Apantesis virgo Linn.
198 Alypia octomaculata Fabr.
199 Homohadena badistriga Grote
200 Mamestra adjuncta Boisd.
201 Euthisanotia grata Fabr.

202 Plusia balluca Geyer.
203 Euchalcia contexta Grote
204 Autographa falcigera Kirby
205 Autographa rectangula Kirby
206 Autographa u-aureum Guen.
207 Catocala relicta Walk.
208 Catocala cara Guen.
209 Catocala amatrix Hübn.
210 Catocala unijuga Walk.
211 Catocala parta Guen.
212 Catocala cerogama Guen.
213 Catocala polygama Guen.
214 Ellida caniplaga Walk.
215 Caripeta divisata Walk.
216 Ennomos magnarius Guen.
217 Xanthotype crocataria Fabr.

FLIES

Diptera

218 Chrysops vittatus Wied.
219 Chrysops niger Macq.
220 Therioplectes microcephalus O. S.
221 Pangonia tranquilla O. S.
222 Tabanus atratus Fabr.
223 Tabanus reinwardtii Weid.
224 Tabanus coffeatus Macq.
225 Tabanus lineola Fabr.
226 Anthrax alternata Say
227 Spilomyia fusca Loew.
228 Temnostoma aequale Loew.
229 Xylota curvipes Loew.
230 Helophilus similis Macq.
231 Sericomyia militaris Walk.
232 Sericomyia chrysotoxoides Macq.
233 Eristalis tenax Linn.
234 Eristalis dimidiatus Wied.
235 Echinomyia algens Wied.

TRUE BUGS

Hemiptera

236 Cicada tibicen Linn.
237 Podisus cynicus Say
238 Ceresa diceros Say
239 Phymata wolfii Stal.
240 Coenus delia Say
241 Belostoma americannum Leidy.

DRAGON FLIES, ETC.

Neuropteroid

242 Gomphus scudderi Selys.
243 Corydalis cornuta Linn.
244 Chauliodes rastricornis Ramb.
245 Polystoechotes punctatus Fabr.

Group of forest insects

This natural group occupied a central glass box and contained 31 species of insects or representations of their work on their food plants; namely, white birch, red oak, elm and maple. There

were 11 species of beetles, 15 of butterflies and moths, 2 of the bee family and 3 of the bug family on the plants or on the ground at their base. The list of the species follows:

Coleoptera

Pales weevil
Hylobius pales Hbst.
Magdalis perforata Horn.
Metachroma marginata Cr.
Pine Chrysomela
Glyptoscelis pubescens Fabr.
Light-loving grapevine beetle
Anomala lucicola Fabr.
Chrysobothris dentipes Germ.
C. floricola Gory.
C. pusilla Bap. & Gory.
Large flat-headed pine borer
Chalcophora virginiensis Drury
Small flat-headed pine borer
Chalcophora liberta Germ.
Callidium antennatum Newm.

Lepidoptera

Spiny elm caterpillar
Euvanessa antiopa Linn.
White marked tussock moth
Notolophus leucostigma Abb. & Sm.
Forest tent caterpillar
Malacosoma disstria Fabr.
Pitch twig moth
Retinia comstockiana Fern.
Salt marsh caterpillar
Estigmene acraea Drury
Black and red woolly borer
Isia isabella Abb. & Sm.
Luna moth
Tropaea luna Linn. (cocoons)
Promethea moth
Calosamia promethea Drury (cocoons)
Cecropia moth
Samia cecropia Linn. (cocoons)
Lithocolletes aceriella Clem. (work)
Incurvaria acerifoliella Fitch (work)
Catocala relicta Walk.
Catocala cara Guen.
Catocala concumbens Walk.
Catocala piatrix Grote.

Hemiptera

Elm bark louse
Gossyparia ulmi Geoff.
Cottony maple scale
Pulvinaria innumerabilis Rathv.
Pine leaf scale
Chionaspis pinifoliae Fitch
Pine Chermes
Chermes pinicorticis Fitch

Hymenoptera

Pine sawflies
Lophyrus abietis Harr.
L. lecontei Fitch

Neuropteroid

Chrysopa species

COLORED PLATES

A series of colored plates were exhibited on the top of the case in two double-faced frames. These plates illustrated the biology and habits of the following species:

Scale insects affecting trees

Three plates illustrating different stages of the appletree bark louse, Lepidosaphes ulmi Linn., the San José scale, Aspidiotus perniciosus Comst., the European fruit scale, Aspidiotus ostreaeformis Curtis, and the scurfy bark louse, Chionaspis furfura Fitch, were included in this group. They are respectively plate 1, 2, 3 and 4 of Museum bulletin 46.

Insects affecting forest trees

This included three plates published in the *7th Report of the Forest, Fish and Game Commission.*

Insects affecting white pine [Plate 13]

1 Nearly full grown larva of imperial moth Basilona imperalis Drury
2 Masses of the pine bark louse Chermes pinicorticis Fitch
3 Pupal cells of white pine weevil, Pissodes strobi Peck under bark of pine log
4 Burrows of larvae of same in bark
5 Portion of dead shoot killed by the insect, showing the circular exit holes, the borings of the insect in upper part and the shrunken area extending down on the affected portion of the twig
6 Pupal cells of white pine weevil within the wood, showing method of exit and also a few exit holes in the shrunken affected bark
7 Adult weevil, Pissodes strobi Peck, enlarged
8 Le Conte's sawfly, Lophyrus lecontei Fitch, larvae in resting position, showing below the stubs of devoured foliage
9 Pine leaf scale insect, Chionaspis pinifoliae Fitch

Insects affecting oak [Plate 16]

1 Egg mass of Anisota senatoria Abb. & Sm. on underside of oak leaf
2 Egg shells of same on partly eaten leaf
3 Shrunken larvae of same infested by parasite on leaf stalks showing the characteristic feeding of the insect
4 Nearly full grown larvae of same
5 Recently hatched larvae feeding side by side and showing the skeletonizing in the earlier stages

6 Male, natural size
7 Female depositing eggs
8 Full grown larva of buck moth, Hemileuca maia Drury
9 Male of same
10 Egg mass of same
11 Cacoecia fervidana Clem., enlarged
12 Nest of same, composed of partly eaten, curled leaves
13 Serica trociformis Burm. on leaf, natural size
14 Same enlarged
15 Two spotted tree hopper, Enchenopa binotata Say
16 Another peculiar tree hopper, Archasia galeata Fabr.
17 Another tree hopper, Thelia acuminata Fabr.
18 Dog day cicada or harvest fly, Cicada tibicen Linn. in its resting position
19 Acorn weevil, Balaninus nasicus Say, natural size
20 Same enlarged

Insects affecting hard pine [Plate 12]

1 Pitch mass of pitch twig moth Retinia comstockiana Fern., with pupal shell protruding therefrom in one case; the other shows old and recent pitch
2 Pitch mass of pitch inhabiting midge, Diplosis resinicola Osten Sacken
3 Shoot infested with Nantucket pine moth larva, Retinia frustrana Scudd., showing the abortive growth
4 Pitch pine needle gall fly, Diplosis pini-rigidae Pack., showing needles deformed by this insect
4a Work on needles of the previous year
5 Needles affected by the pine leaf miner, Gelechia pinifoliella Chamb., note the brown tips of the affected needles
6 A pine sawfly larvae, Lophyrus abietis Harris in natural position on the needles; below are stubs of eaten needles
6a Cocoon of same at base of pine needles
7 Pine Chrysomela, Glyptoscelis pubescens Fabr., much enlarged
8 Pales weevil, Hylobius pales Herbst., much enlarged
9 Chrysobothris pusilla Bap. & Gory, much enlarged
10 Chrysobothris floricola Gory, enlarged
11 Chrysobothris dentipes Germ., much enlarged
12, 13 and 14 Varieties of the light-loving grapevine beetle, Anomala lucicola Fabr., a species which is very abundant on hard pines
15 Pilophorus crassipes Uhl., much enlarged
16 Magdalis alutacea Lec., much enlarged
17 Magdalis perforata Horn, much enlarged
18 Lace-winged fly, Chrysopa species
18a Cocoons of same on needles

Insects affecting shade trees

This group was represented by six plates:

1 A plate illustrating in detail the life history and habits of the white marked tussock moth, Notolophus leucostigma Abb. and Sm., and the forest tent caterpillar, Clisiocampa disstria Hübn. [Pl. 1 of author's paper on *Insects Injurious to Forest Trees*, published in the *4th Annual Report of the Commissioners of Fisheries, Game and Forests*].

2 A plate illustrating in detail the life history and habits of the gipsy moth, Porthetria dispar Linn. [Pl. 1 of *16th Report of the State Entomologist*].

3 A plate illustrating in detail the life history and habits of the elm leaf beetle, Galerucella luteola Müll., and the bag or basket worm, Thyridopteryx ephemeraeformis Haw. [Pl. 1 of author's paper on *Insects Injurious to Elm Trees*, published in the *5th Annual Report of the Commissioners of Fisheries, Game and Forests*].

4 A plate illustrating the life history and habits of the sugar maple borer, Plagionotus speciosus Say, the twig girdler or tree pruner, Elaphidion villosum Fabr., and the cottony cushion scale, Pulvinaria innumerabilis Rathv. [Pl. 3 of the author's paper on *Insects Injurious to Maple Trees*, published in the *4th Report of the Commissioners of Fisheries, Game and Forests*].

5 A plate illustrating in detail the life history and habits of the brown tail moth, Euproctis chrysorrhoea Linn. [Pl. 1 of *18th Report of the State Entomologist*].

6 A plate illustrating in detail the life history and habits of the elm borer, Saperda tridentata Oliv., elm snout beetles, Magdalis armicollis Say and M. barbita Say, and the elm bark louse, Gossyparia ulmi Goff. [Pl. 3 of author's paper on *Insects Injurious to Elm Trees*, published in the *5th Annual Report of the Commissioners of Fisheries, Game and Forests*].

STUDIES IN CULICIDAE

The Culicidae in both adult and larval stages present many interesting modifications which are reflected to a greater or less extent in their life history and habits. The latter are frequently of considerable economic importance and therefore a knowledge of the former is exceedingly desirable. The following studies have for their object a better understanding of the group and more particularly a clearer delimitation of species because recently there has been in more than one instance a sad confusion of distinct forms. Experience has shown the difficulty of drawing specific lines even when one was sure that he was dealing with two forms. It sometimes occurs in this group that widely divergent adults produce very similar larvae and conversely that easily separable larvae transform to adults which can be distinguished from each other only with great difficulty. These vexatious problems can be solved satisfactorily only by careful rearing and thorough study of all the

characters presented in both larval and adult stages. Dry material has value in this work, though better preparations can be obtained from recently killed insects, and it has been our aim to rear, so far as possible, all of our native species and thus obtain the clearest possible idea of their characteristics in both adult and larval stages. The following observations are made public at this time because they should prove of considerable service to others engaged in similar investigations, and particularly because they deal with a comparatively unworked field.

The material on which these studies are based, has been derived from a number of sources. The most important contribution of exotic forms was obtained through the kindness of Prof. F. V. Theobald of England, a recognized authority on this group. Representatives of additional species have also been received from Dr Andrew Balfour of Khartum Egypt, Dr M. Grabham of Kingston Jamaica, and of Philippine forms from C. S. Ludlow, Surgeon General's Office, Washington. A large proportion of native material has been obtained by collecting and rearing, though we are deeply indebted to the kindness of Dr H. G. Dyar of Washington, Dr J. B. Smith of New Jersey, Dr W. E. Britton of Connecticut, Prof. Glenn W. Herrick of Mississippi, Prof. V. L. Kellogg of California and H. J. Quayle, also of California, for adults or larvae from different sections of the country. Special mention should also be made of Mr J. Turner Brakeley of Hornerstown N. J., who very kindly sent examples of several rare and extremely interesting species.

LARVAE

The larvae of this group are of peculiar interest because most repressive or exterminative work must be directed against them, and the ability to recognize species in the immature stage is frequently of the greatest value in determining the most satisfactory method of treating a mosquito-breeding area. Environment is of considerable value in determining mosquito larvae, since certain species exhibit decided preferences in breeding places, some being found only in or near brackish or salt water, others only in fresh water, a few in foul water, some in warm, fresh water, while others prefer cool spring-fed pools, tree holes or holes in rocks and other diverse places. The larvae as a rule subsist on decaying vegetable matter and algae, though certain species, notably Psorophora, Corethra, Eucorethra and Sayomyia are carnivorous, and the first named in particular, is probably of considerable economic importance, since these predaceous larvae undoubtedly devour large numbers of the smaller pestiferous mosquitos.

Structural characters are of great importance in separating the larvae of this entire group. Occasionally color is of considerable service, yet it is always of secondary importance, since it is largely influenced by environment. The general shape of the head, the form of the antennae, and the position of the antennal tuft are all of considerable service in identifying species. The cephalic setae and the arrangement and character of the hairs on the body are also of some value.

The most prominent and peculiar structure is found in the air tube, or, as it is termed by some, the siphon. This structure exhibits a wide diversity in development, being entirely absent in Sayomyia, very short in the Anophelinae, rudimentary in Corethra and with widely varying proportions in the Culicinae. The general form and size of this important organ is of considerable value in identifying species and the presence or absence of setae, including the modified peculiar pecten at the base of the air tube, afford excellent characters for the separation of larvae. The hair tufts on the dorsal or anterior portion of the air tube vary considerably. The air tube of Wyeomyia smithii Coq. is remarkable because of the irregularly disposed setae occurring on all sides. Culicada trichurus Dyar may be easily distinguished by the anterior or dorsal series of hairs on the air tube, while species belonging to Culiseta are at once recognizable by the unique prolongation of the posterior pecten into a series of fine hairs extending nearly to the tip of the air tube. The minor modifications of the more normal pecten teeth are also of considerable service in the recognition of species. Many forms have one or several teeth widely separated from the basal, nearly continuous row of teeth found in others.

The most interesting and valuable structure for classificatory service, though unfortunately a somewhat inconspicuous one, is found in the peculiar patch of spines or spinelike scales designated as the comb. This is normally a lateral organ of the eighth segment just beneath the air tube. It is usually triangular in form and may be composed of from five to nearly 100 individual scales or spines. These are usually attached to the unmodified skin, though occasionally they arise from the posterior border of a chitinized plate or are even attached to a somewhat chitinized band. In either of the two latter cases they are arranged in a single or double row. The spines or scales themselves differ widely in structure, some being simply thornlike in form, others with setaceous margins and some with large apical and smaller subapical spines. A greater divergence

from the thornlike tip is seen in those with scales tipped with a nearly uniform series of ciliate or setaceous processes. The comb of Psorophora is exceedingly peculiar in that the posterior margin of stout, trispinose scales partially incloses an area thickly clothed with much finer scales, each with its posterior margin finely serrate like the teeth of a comb. There are considerable variations in the number of scales on certain species, and in most forms having a large number of scales in the comb, there is frequently a great difference in structure between the component scales, the greatest divergence from the type form being observed at the dorsal or ventral angles of the patch. The Anopheline larvae are remarkable because of the highly specialized comb. It is subdorsal and consists of a basal plate bearing a series of posterior, sometimes pectinate teeth, a structure widely different from that presented by other Culicidae.

The degree of chitinization of the anal or ninth segment is frequently of considerable value in identifying species and there is considerable variation in the ventral tuft. This is greatly developed in certain forms and almost rudimentary in others. A most interesting structure occurs on this segment in Megarhinus larvae; namely, a rudimentary spiracle indicating plainly a former terrestrial habit. Corethrinae larvae have this segment very weakly chitinized and the larvae of Sayomyia may at once be recognized by the peculiar ventral hooks attached to the posterior extremity.

Key for the identification of mosquito larvae

Identification of mosquito larvae is of importance in all work designed to control these species, and this is particularly true of localities where prevention of disease is the main object. This being the case, we have taken the opportunity of revising and extending our recently prepared table for the separation of larvae, in the hope that it will prove of service to those engaged in control work of one kind or another.

a Air tube long, at least four times as long as the diameter of its base
  b Air tube very long, slender, slightly constricted in the middle; antennae white banded.....Little black mosquito, Culex territans
  bb Air tube very long, stout, tapering uniformly
    c Comb scales 60, pecten teeth three to four branched.....Unbanded marsh mosquito, Culex salinarius
    cc Comb scales about 80, pecten apparently simple.....Culicella dyari
    ccc Comb scales narrow, spinelike, about 20 in a row, resembling a grating.....Culicella melanurus
  bbb Air tube about five times the width of its base
    c Pecten pale, divided into three to five long, slender processes

d Antennal tuft before the middle.....
White dotted mosquito, Culex restuans
dd Antennal tuft at outer third
e Antennae not white banded, air tube somewhat fusiform; terminal spines of comb scales fine.....
House mosquito, Culex pipiens
ee Antennae usually conspicuously white banded, air tube tapering
f Air tube not over four times as long as wide, terminal spines of comb scales coarse.....Culex tarsalis
ff Air tube over four times as long as wide, terminal spines of comb scales fine.....Culex secutor
cc Pecten teeth pale, divided into two nearly equal processes.....
Deinocerites cancer
ccc Pecten teeth almost black, about 20 in number, with small basal dentitions; comb scales about 25
d Pecten rows continuous, the large apical spine of the comb scales being from one third to one half the length of the entire structure
Culicada fitchii
dd Pecten with several isolated apical teeth
e Lateral hairs of first abdominal segment double, detached teeth of pecten well spaced.....Culicada abfitchii
ee Lateral hairs of first adbominal segment single, apical pecten teeth only a little detached.....Culicada vittata
aa Air tube moderate in length, from about two to four times longer than its greatest diameter
b Air tube decidedly fusiform
c Antennae long, anal segment long; comb consisting of six or seven subequal spines.....Janthinosoma musica
cc Antennae moderate, apical portion black; anal segment short, wider than long, with four pecten teeth on the basal half of the air tube
Grabhamia jamaicensis
bb Air tube greatly enlarged at the base, linear apically and crowned with a circle of recurved spines
Taeniorhynchus perturbans (young)
bbb Air tube tapering uniformly and bearing irregularly placed, large setae along its entire length; comb scales 10 in a single row
Wyeomyia smithii
bbbb Air tube without pecten; no comb scales
c Conspicuous air reservoirs in the thoracic and seventh abdominal segments; larvae aquatic.....Corethra
cc No conspicuous air reservoirs; air tube bearing several long apical setae.....Corethrella brakeleyi
bbbbb Air tube with pecten, more or less tapering; comb scales present
c Seventh abdominal segment with a large dorsal plate, comb consisting of a double row of slender spined scales attached to the posterior edge of a chitinous plate; air tube without pecten
Pneumaculex signifer
cc Seventh abdominal segment without dorsal plate
d Comb scales not more than 10
e Comb scales quadrate, with a very long median spine and shorter lateral ones

f Comb scales 5-8 attached to a slight band; pecten teeth 5-8 dividing into 2-4 very long, slender processes
Grabhamia discolor

ee Comb scales rather broadly spatulate at the base, few, arranged in a curved line

f Comb scales five, pecten teeth 7-9, minutely serrate near the middle.....Protoculex serratus

ff Comb scales six, pecten teeth 12-16, stoutly toothed near the middle.....Culicada abserratus

fff Comb scales 8-10 in a curved line; 12 pecten teeth with short basal spines.....Culicada dupreei

ffff Comb consisting of eight simple, spinelike processes attached to the posterior margin of a large lateral plate; air tube slightly curved; pecten with basal portion thick, margins and apical parts nearly transparent, serrate.....
.....Uranotaenia sapphirina

dd Comb scales ranging from 10-24

e One or more pecten teeth widely separated from a continuous row

f Two rows of slight tufts of hair on the dorsum of the air tube; comb scales 14-16, usually four pecten teeth widely separated from the remainder of the row.....
Northern gray mosquito, Culicada trichurus

ff No such dorsal tufts on the air tube

g Air tube slender, tapering equally, the continuous pecten extending only to the basal fifth of the air tube; pecten teeth 2-3, toothed; comb scales 10-14 (Smith 18-20).....
.....Swamp mosquito, Ecculex sylvestris

gg Air tube slender, tapering slightly, the continuous pecten, each usually with a single tooth, extending to the basal fourth; two or three somewhat flattened, isolated pecten teeth extending beyond the middle, the tufts near the apical third; comb scales 12 nearly in a single row .....
..... Aedes fuscus

ggg Air tube stouter, slightly swollen, continuous pecten extending to the basal third, 15-18, with 2 isolated pecten teeth 1-2 toothed; comb scales 14 in a somewhat irregular triangular patch, spatulate, each with a rather stout terminal spine;.....Culicada impiger

ee Pecten in a continuous row, distal teeth not widely separated

f Comb scales narrow, elongate, tapering, 12 in an irregular double row, finely setose apically.....
..... Culicada triseriatus

ff Comb scales 16, elongate, base slightly elliptic, sides and apex evenly spined..... Culicada varipalpus

fff Comb scales with a distinct spatulate base and large apical spine

g Comb scales 14-22, the minor spines nearly as long as the median one.....Culicada trivittatus

gg Comb scales in a triangular patch, about 16, each with one or two very short, subapical spines.....
.....Culicelsa auroides
ggg Comb scales in a curved line, about 15 and with a patch of much finer, comblike scales anteriorly; a large species 1½ inches long...Giant mosquito, Psorophora ciliata
ddd Comb scales 25 or more
e Antennal tuft before or at the middle
f Pecten pale, prolonged into setae; comb scales digitately divided
g Chitinized parts very dark, stout.....
.....Theobaldia incidens
gg Chitinized parts lighter and weaker
h Comb scales about 60, pecten teeth with one or two basal processes.....Culiseta absobrinus
hh Comb scales 40, pecten teeth with two or three basal processes.....
Culiseta consobrinus (C. magnipennis)
ff Pecten not as above
g Tuft of antenna reduced to a single hair; comb scales about 46, in five rows, several pecten teeth widely separated from the remainder.....Culicada atropalpus
gg Tuft of antennae normal
h Comb scales with a moderate apical spine, narrowly spatulate at base
i Comb scales 28-64; mouth brush moderate; tip of antennae dark.....
Woodland pool mosquito Culicada canadensis
ii Comb scales 25; mouth brush large.....
.....Culicada pullatus
hh Comb scales each with a stout apical spine, broadly spatulate at base
i Air tube about three times as long as its greatest diameter; antennae moderately long with a slight swelling near the base, 25-50 comb scales and 16-24 pecten; head immaculate.....
Brown wood mosquito, Culicada subcantans
ii Air tube about twice as long as its greatest diameter; antennae shorter, without a swelling near the base; spines and scales as above; head maculate.....
Brown salt marsh mosquito, Culicada cantator
hhh Comb scales with 4-6 stout, nearly equal apical spines, somewhat spatulate at base.....
i Comb scales about 60 in number.....
.....Culicada lazarensis
ii Comb scales about 30; pecten teeth 19.....
.....Culicada curriei
ee Antennal tuft beyond the middle
f Comb scales about 80, in a triangular patch of 10 rows, pecten apparently simple.....Culicella dyari
ff Comb scales 25-30, pecten small, 14-20, minutely toothed
.....Golden mosquito, Culicelsa aurifer

aaa Air tube very short, not more than 1½ to 2 times as long as broad
b Pecten teeth dentate on both sides, comb with 16-24 scales; head maculate...Small salt marsh mosquito, Culicelsa taeniorhynchus
bb Pecten teeth dentate on one side only
c Antennal tuft normal
d Comb scales 28-40, pecten teeth about 14; head generally immaculate....Salt marsh mosquito, Culicada sollicitans
dd Comb scales five, pecten teeth 7-9, minutely serrate near middle .....Protoculex serratus
cc Antennal tuft reduced to a single hair
e Pecten extending nearly to the apex of the air tube; comb scales about 46, with subequal terminal spine.....Culicada atropalpus
ee Pecten extending to the middle of the air tube; comb scales 10, each with a large median tooth and smaller lateral ones.....Yellow fever mosquito, Stegomyia fasciata
bbb Pecten simple, with stout spines; comb a single row of 12 simple spines, stellate hairs on the body..... Howardina walkeri
bbbb Pecten absent; comb represented by a large plate with two long barred setae posteriorly; larvae about ¾ inch long.....Megarhinus portoricensis
aaaa No air tube or a very short one
b Next to the last segment with a flat dorsal area in which may be seen two spiracles
c Medium size species, floating just below the surface of the water; comb consisting of a tooth-bearing plate
d Comb teeth of equal length.....Anopheles barberi
dd Comb teeth of two sizes, long and short
e Comb teeth with large branches between them.....Cellia albipes
ee Comb teeth with only fine obscure pectinations
f Secondary teeth of the comb less than half as long as the primary ones..Anopheles crucians, A. maculipennis
ff Secondary teeth of the comb over half as long as the primary ones...Anopheles punctipennis, A. franciscanus
cc Large species with no comb; mandibles strongly developed; floating just below the surface of the water, limited to cold northern pools.....Eucorethra underwoodi
bb Last segment usually with hooks, no spiracles apparent and no signs of an air tube; larvae almost transparent, the only color being the black eyes and pigmented air sacs in the thoracic and seventh abdominal segments.....Phantom larvae, Sayomyia

DESCRIPTIONS OF NEW OR INSUFFICIENTLY CHARACTERIZED SPECIES

Culicelsa auroides n.sp.

Several larvae of this species were taken at Elizabethtown N. Y., and were at first supposed to be the young of C. aurifer Coq. A close study, however, showed marked structural differences between

the two in the larval stage, though the adults present a very similar appearance. It is therefore described as a new form.

Female. Proboscis dark brown, about two thirds the length of the body. Palpi short, dark brown, third segment about one third the length of the stout uniform fourth segment; fifth rudimentary. Antennae a little shorter than the proboscis. Basal segment yellowish brown, fuscous internally and with an inconspicuous patch of whitish scales dorsally and internally; other segments dark brown with medium basal whorls and thinly clothed with short golden setae. Occiput thickly clothed with curved, golden yellow scales and with numerous erect, golden yellow, fork scales posteriorly. Mesonotum with a conspicuous median stripe of rich brown scales, becoming yellowish, thinner and obsolete posteriorly. A short, sublateral line of the same color occurs on the posterior third; other portions of mesonotum rather thickly clothed with golden yellow scales. Pleura thickly clothed with silvery white scales. Scutellum rather thickly clothed with long, golden yellow scales and with a conspicuous median and smaller lateral apical groups of long, golden yellow setae; postscutellum smooth, dark brown. Halteres, apical portion slightly fuscous, basal semitransparent, whitish. Abdomen dark brown with distinct basal yellowish white bands, slightly prolonged laterally. Terminal lobes fuscous. Ventral surface suffused with yellowish white scales. Coxae brownish yellow, rather thickly clothed with whitish scales; legs brown, unbanded. Femora and tibiae yellowish white ventrally; tarsi dark brown, tarsal claws unidentate. Wings with costa and first longitudinal vein thickly clothed with purple brown scales, subcosta and other veins more sparsely ornamented; fringe a purplish gray. Petiole of first submarginal cell about two thirds the length of the cell; that of the second nearly as long as its cell. Posterior cross vein a little over its own length from the mid cross vein.

Described from a freshly bred, isolated specimen obtained May 12 in the larval stage at Elizabethtown N. Y. The larva presents some marked differences, particularly in the shape of the antennae at least, from that of the typical aurifer received from Mr Brakeley of Hornerstown N. J.

Larva about $\frac{3}{5}$ inch long. Antenna brown, slightly fuscous apically, stout, slightly swollen at the base; gently curved and tapering gradually to a somewhat blunt apex. Tuft at the basal third consisting of about four apparently simple hairs. Tip with one long segmented apical process, a shorter, much more slender one, a stout, long process and a considerably stouter, short one. Surface, specially apically, ornamented with rather large, stout, somewhat isolated, chitinous spines. Labial plate broadly triangular with about 25 rather fine teeth. Comb consisting of a somewhat triangular patch of about 16 scales, each with a spatulate, enlarged base, coarsely and rather sparsely setose on the sides and with a stout subapical and a rather long apical spine, the latter as long or longer than the body of the scale. Air tube stout, about three times as

long as broad, slightly swollen at the basal third and tapering gradually to the tip. Pecten consisting of two rows of closely set, stout, dentate spines, 20 to 24 in each, with a compound hair just beyond the tip of each and at about the middle of the air tube, each tooth usually with one large and two or three smaller denticulations, basal portion about one half the length of the longer terminal spine. Chitinous ring of ninth segment about two thirds as long as broad, inclosing the entire segment, barred area short. Dorsally there is a long, simple caudal seta.

This larva presents a striking resemblance to that of the typical C. aurifer larvae from New Jersey. A close examination, however, shows that marked differences are presented by the antennae, the tuft being at the basal third in this form instead of beyond the middle, as in the true aurifer. There are more teeth in the labial plate and an examination of the comb scales reveals a considerable difference between the lateral serrations at the base which, in this form, have the two subapical teeth on either side of the central spine considerably stouter than the preceding ones, whereas in the true aurifer there is no such marked difference. The teeth of the pecten are more closely set and in aurifer the base of each pecten tooth is a little stouter and usually possesses more serrations. The chitinous ring of the ninth segment incloses the segment in this form and does not in aurifer.

Culex fitchii Felt & Young

This medium sized species is a very characteristic form and well colored examples may be easily recognized by examining the mesonotum which is ornamented with rich brown submedian vittae bordered laterally by a broad area clothed with loose, curved, silvery scales. It flies from about the middle to the latter part of May, and its larvae occur in association with a number of early spring forms. It, like the adult, is very characteristic and may be recognized by its long, uniformly tapering air tube with the continuous, closely placed row of jet-black pecten at its base. This larva appears to be confined very largely to open grassy pools such as are found along roadsides or in meadows, where it may be taken in association with the larvae of C. subcantans, C. abfitchii, C. trichurus, C. impiger, Aedes fuscus, Corethra karnerensis and C. cinctipes.

This species is later in appearance than such early spring forms as C. cantans, C. cinereoborealis and C. abfitchii, all of which fly before adults of this species begin to appear. Culicada impiger and Aedes fuscus are fully as early, though their breeding period is more prolonged and the two latter

forms are consequently found much later in the season. This larva is a very difficult one to rear. Abraded adults present a strong resemblance to Culicada subcantans and C. abfitchii. Males of this species are easily separated from the two last named, since the basal clasp segments bear a conical tuberculate process thickly set with numerous long, stout setae, a structure practically absent in Culicada abfitchii, and one that is represented only by a rudimentary lobe and a conspicious slightly curved, chitinous spine in Culicada subcantans.

Female. Proboscis about two thirds the length of the body, dark brown, rather thickly flecked almost its entire length with silvery white scales. Palpi dark brown, flecked with white scales, particularly at the base of the segments. Basal segment of antennae reddish brown with a minute internal patch of white scales; other segments dark brown with sparse basal whorls of long, dark setae and a scanty clothing of fine, yellowish hairs. Occiput with a conspicuous median group of hairs at the juncture of the eyes and with a broad median stripe of silvery white scales, and somewhat indistinct patches of brown scales. Numerous erect, white and black, fork scales posteriorly. Laterally the posterior portion of the head is thickly clothed with yellowish white scales inclosing a small dark patch. Mesonotum with broad, submedian vittae of thick, dark brown scales becoming grayish and obsolete posteriorly. Sublaterally there is a somewhat irregular area of silvery yellow scales, the central posterior portion shaded with dark brown scales and on the lateral anterior angles there are conspicuous patches of dark brown scales. Pleura rather sparsely and irregularly clothed with silvery white scales. Scutellum sparsely clothed with yellowish white scales and with a conspicuous median and smaller lateral groups of long, golden yellow setae; postscutellum smooth, light brown. Halteres with the apical portion slightly fuscous, basal part yellowish transparent. Abdomen dark brown with distinct basal bands, slightly prolonged mesially, very narrow laterally, or sublaterally, in some specimens distinctly prolonged laterally, of silvery white scales, those of the sixth and seventh segments occupying half and three fourths respectively, of the dorsal area; eighth segment nearly naked, the tip of the terminal lobes dark brown. Ventral surface rather thickly clothed with yellowish white scales except for a more or less obsolete broken median black line and a brown patch at the lateral posterior angles of each segment. Coxae pale yellowish, sparsely clothed with whitish scales. Femora largely light yellow with more or less irregular flecking of dark brown scales. Tibiae much darker than the femora. Apex brown, articulation yellow. Tarsi dark brown, those of the posterior legs with broad distinct basal bands on the second, third and fourth segments, which are narrower and nearly uniform on the mid and fore tarsi. Basal bands of the first tarsal segments illy defined. Claws unidentate, concave surface of teeth finely serrate. Wings with the costa thickly

clothed with dark brown scales interspersed with numerous yellowish ones; subcosta and first and second longitudinal veins more sparsely clothed with similar scales; fringe pearly gray. Petiole of first submarginal cell about two thirds the length of the cell,that of the second as long as its cell. Posterior cross vein a little over its own length from the mid cross vein.

Described from a freshly reared specimen.

Male. Proboscis about two thirds the length of the body, dark purple. Palpi dark brown, the third segment capitate and with a broad basal and a median white band, a lateral whitish patch of scales apically, with a rather sparse ventral tuft and with two short, stout, subapical setae; this segment one third longer than the combined nearly equal fourth and fifth segments, the fourth with a broad, well defined, white basal band, the fifth with a rudimentary basal band of the same color, more slender than the fourth and extending its own length beyond the proboscis. Antennae, basal segment dark brown with a conspicuous internal patch of white scales, densely clothed with grayish yellow plumes basally. Segments 13 and 14 about half the length of the entire organ, 14 being three fourths the length of 13. Occiput rather sparsely ornamented with silvery yellow, curved scales and rather numerous erect white and a few black, fork scales posteriorly. The lateral posterior margin of the head is clothed with a rather thick patch of silvery white scales. Mesonotum with broad, submedian, dark brown stripes becoming silvery yellow and obsolete posteriorly, sublaterally a rather broad, yellowish white stripe and at the anterior lateral angles more or less conspicuous brownish spots. Pleura rather sparsely clothed with silvery white scales. Scutellum sparsely clothed with yellowish white scales and with large, median and conspicuous lateral apical tufts of long, golden yellow scales; postscutellum smooth, light brown. Halteres with the apical portion more or less fuscous, basal whitish transparent. Abdomen dark brown with distinct, rather broad basal yellowish white bands slightly produced laterally, those on the fifth and sixth segments covering the anterior half and that on the seventh most of the segment; the eighth sparsely clothed with silvery white scales. Basal clasp segment dark brown. Ventral surface rather sparsely suffused with silvery white scales, with a somewhat broken median stripe of brown scales. Coxae yellowish brown; legs banded, dark brown; the femora and tibiae well flecked with yellowish white scales, their ventral surface yellowish. Tarsi with well marked basal bands, those on segments 1 to 4 of the hind legs broad, those of the fore and mid legs on segments 2 to 3, narrow, bright, that of the fourth of the mid legs and the fifth of the hind legs narrow or rudimentary. Claws of anterior and middle legs unequal (the shorter simple), the longer claw of the middle leg being nearly straight. Wings with the costa clothed with dark brown scales, first and second longitudinal veins more sparsely ornamented with light brown scales mixed with yellowish ones; fringe pearly gray. Petiole of first submarginal cell about the same length as the cell, that of the second about one third longer. Posterior cross vein about its own length from the mid cross vein.

Described from two freshly bred specimens presenting marked colorational differences from C. abfitchii.

Culicada abfitchii Felt

This is one of the large early spring forms found breeding in considerable numbers in open grassy pools, the adults beginning to appear about the time that Culicada subcantans has ceased to emerge. Examples of this species are separated with difficulty from the last named form and may be recognized most readily by their slightly later appearance and by the somewhat definite, narrow, silvery, sublateral lines between the submedian and lateral brownish areas of the mesonotum. There is also a difference in the male genitalia, there being no conspicuous basal enlargement or stout chitinous spine at the base of the first clasp segment in this species, whereas in C. subcantans there is a rudimentary lobe bearing a stout, chitinous spine. The larva of this form is about the same size as that of C. subcantans. It may be easily distinguished therefrom by the longer, tapering air tube and the smaller number of slender comb scales. This larva is in turn readily differentiated from that of Culicada fitchii by its stouter air tube, and in particular by the two isolated, well separated teeth terminating the pecten. There is also a marked though more minute difference in the comb scales of these two species. The large apical spine of the comb in this form is from one half to two thirds the length of the entire structure, whereas in C. fitchii the apical spine is only from about one half to one third the length of the scale.

Life history. This species probably winters in the egg, the larvae hatching very early in the spring. There is but one generation, as this species is not met with after the middle to the latter part of May. The larvae are confined very largely to grassy pools, occasionally breeding therein in considerable numbers, though more frequently occuring rather sparingly. They exhibit a marked tendency to shelter themselves under overhanging grass, and random dips in pools apparently uninhabited, have repeatedly been fruitful in securing larvae of this species. It is a difficult form to rear and owing to its close resemblance to C. subcantans, it has undoubtedly been confused with that species. The larvae are found in association with the very early spring forms, Culicada trichurus, C. abfitchii and the slightly later species, C. fitchii, C. canadensis, C. impiger, Corethra karnerensis and C. cinctipes.

Female. Proboscis straight, about two thirds as long as the body, light brown, flecked with numerous white scales near the middle, particularly on the underside, dark brown apically. Palpi short, dark brown; base of third and fourth segments narrowly and irregularly ringed with white scales, third about one half as long as the fourth, which bears a moderate rudimentary subglobular fifth segment. Antennae, basal segment light brown,

slightly fuscous internally and with a conspicouus patch of white scales; other segments dark brown except the basal ones and with sparse basal whorls of dark brown hairs and a rather thick clothing of somewhat long, whitish hairs. Occiput thickly clothed with golden yellow scales and numerous upright white and black fork scales posteriorly, a median tuft of yellowish white scales at the juncture of the eyes, another a little behind the same, and a well defined larger lateral stripe of white scales inclosing a black patch. Under surface of the head rather thickly clothed with yellowish white scales. Mesonotum thickly clothed with golden brown scales, there being a well defined submedian stripe narrowly bordered by a line of scattering silvery scales, which latter are also sparingly present in the sublateral stripes. Submedian brown stripes obsolete posteriorly, where there is a sparse clothing of silvery white or yellowish scales. Pleura sparsely clothed with small patches of silvery white scales. Scutellum sparsely clothed with golden yellow scales, with a conspicuous median and a pair of submedian groups of long, golden yellow bristles; postscutellum smooth, dark brown. Halteres slightly fuscous apically, whitish transparent basally. Abdomen dark brown with distinct basal bands of yellowish white scales much prolonged laterally and somewhat so mesially, the latter being more pronounced on the fourth, fifth and sixth segments. Sixth segment slightly and seventh almost suffused with yellowish white scales; eighth sparsely clothed. Apex of terminal lobes dark brown. Ventral surface suffused with yellowish white scales. Coxae yellowish brown, clothed with irregular patches of whitish scales. Legs dark brown flecked with yellowish white scales and distinctly banded. Ventral surface of femora and tibiae yellowish white, the latter with a distinct yellowish apical band. Basal band of first tarsal segment rather indistinct, that of the second, third and fourth usually broad and well defined on all the legs. Posterior legs with a well defined basal band on the last tarsal segment, indistinct or wanting on the mid and fore legs. One specimen has the fourth tarsal segment of the second and third pair of legs entirely white, the third being brown. Tarsal claws apparently unidentate. Wings clothed with dark brown scales with many yellowish white ones interspersed; fringe pearly gray. Petiole of first submarginal cell about two thirds the length of the cell, that of the second about as long as the cell. Posterior cross vein more than its own length from the mid cross vein.

Described from freshly bred specimens from Nassau, Ap. 8, 1905.

Male. Proboscis about two thirds the length of the body, brown with numerous whitish scales near the middle, dark brown at the apex. Palpi extending beyond the proboscis, a rather broad, yellowish band near the apex of the third segment, much of the fourth and considerable of the fifth being yellowish white or whitish, the other scales dark brown. Extreme base of the third and tip of the second segment yellowish; plumes moderate in length, yellowish with gray apexes; third segment capitate with several short, stout, subapical setae and about one fourth longer than the combined fourth and fifth segments, the latter two about equal.

Antennae moderate, densely clothed with grayish plumes, largely yellowish at the base. Basal segment globose, dark brown, with a rudimentary internal patch of white scales; segments 13 and 14 longer than all the others, the distal a little shorter than the 13th. Occiput rather sparsely clothed with golden yellow scales intermingled with numerous upright black fork scales. Mesonotum rather thickly clothed with golden yellow scales, obsolete or very sparse posteriorly. There is a narrow sublateral line of whitish scales along the posterior third; laterally the scaling is much thinner. Pleura with a few small scattering patches of white scales. Scutellum with a small median patch of yellowish white scales, a median apical group of long, golden yellow setae and a pair of smaller lateral groups; postscutellum smooth, yellowish brown. Extreme apex of halteres fuscous, other portions yellowish white. Abdomen dark brown with very broad, somewhat diffuse basal bands of whitish or yellowish white scales somewhat prolonged laterally. Seventh and eighth segments sparsely covered with yellowish or yellowish white scales. Basal clasp segments dark brown, sparsely clothed with long hairs. Ventral surface suffused with golden yellow scales. Coxae yellowish brown, irregularly and sparsely clothed with whitish scales. Legs dark brown, rather thickly flecked with yellowish white scales and with broad bands on the second to fourth tarsal segments of the mid and posterior legs, the bands of the first and fifth tarsal segments and those of the anterior legs narrow or indistinct. Claws unidentate, those of the fore and middle legs unequal. Wings with costa thickly clothed with dark brown scales, others sparsely ornamented with dark brown and yellowish scales intermixed. Fringe pearly gray. Petiole of first submarginal cell about the same length as the cell, that of the second one third longer. Posterior cross vein less than its own length from the mid cross vein.

Described from a freshly bred specimen taken at Nassau, May 8, 1905.

Culicada abserratus Felt & Young

This species appears to be a somewhat common spring inhabitant of rather cool, elevated forest pools. It was first characterized from several larvae and one poorly developed bisexual individual. It has been possible since to breed a good series of both sexes and detailed descriptions are given herewith.

Female. Proboscis nearly uniform dark purple, about two thirds the length of the body. Palpi dark brown, slightly darker apically. Third segment about two thirds the length of the somewhat dilated fourth, fifth rudimentary subglobular. Basal segment of antenna globose, dark brown, with a minute internal patch of white scales; other segments dark brown with sparse basal whorls and a scanty clothing of fine setae. Occiput rather sparsely clothed with golden yellow scales with upright yellow fork scales posteriorly and a few black fork scales laterally. Mesonotum thickly clothed with golden yellow scales and with rather

conspicuous dark brown submedian vittae becoming obsolete posteriorly. Pleura rather sparsely clothed with silvery white scales. Scutellum dark brown with a scanty median patch of yellowish white scales, a scanty median apical group of golden yellow setae and smaller lateral groups of the same character; postscutellum smooth, dark brown. Halteres with the extreme apex dark brown, basal portion silvery white. Abdomen dark brown with distinct basal bands nearly obsolete on the median line and well produced laterally, these on the fifth and sixth segments extending to the posterior fourth. Seventh segment scantily and somewhat irregularly clothed with silvery white scales. Eighth segment naked, dark brown, terminal lobes almost fuscous. Ventral surface sparsely clothed with silvery white scales, nearly absent on the median line; venter of eighth segment naked. Coxae brownish, sparsely clothed with silvery white scales; legs unbanded, dark brown. Ventral surface and tip of femora yellowish; claws unidentate. Wings with the costa clothed with very dark brown scales, the other veins somewhat sparingly ornamented with brownish scales; fringe pearly gray. Petiole of first submarginal cell about two thirds the length of the cell, that of the second about as long as its cell. Posterior cross vein more than its own length from the mid cross vein.

Described from a freshly reared specimen taken at Nassau, May 10, 1905.

Male. Proboscis uniformly dark purple, about two thirds the length of the body. Palpi unicolorous, dark purple, about as long as the proboscis and with moderate purplish plumes; third segment slightly capitate, about half as much longer as the third and fourth combined, the latter somewhat dilated at the apical third. Antennae about two thirds the length of the palpi, dark purple with thick, purplish plumes shaded with gray; 13th and 14th segments subequal, about as long as all the others combined. Occiput rather sparsely and uniformly clothed with silvery yellow scales and with numerous black, erect, fork scales posteriorly. Mesonotum rather thickly and uniformly clothed with golden yellow scales becoming white and sparse posteriorly. Pleura rather thickly and irregularly clothed with large patches of silvery white scales. Scutellum with a rather thick median patch of yellowish white scales, a conspicuous apical group of golden yellow bristles and smaller lateral ones of the same color; postscutellum smooth, dark brown. Halteres, apical portion slightly fuscous, basal yellowish transparent. Abdomen dark purplish with conspicuous fine lateral hairs and distinct basal yellowish white or white bands. The latter is somewhat irregular, slightly prolonged laterally specially on the sixth and seventh abdominal segments; eighth nearly covered with silvery yellow scales. Basal clasp segments dark purple and ornamented with several conspicuous brown setae. Ventral surface purplish brown, sparsely clothed laterally with silvery white scales. Coxae yellowish brown, sparsely clothed with silvery white scales. Legs dark brown, unbanded; femora

and tibiae with some shading of yellow and largely yellowish ventrally. Claws unidentate, those of the fore and mid legs unequal. Wings with costa and first and second longitudinal veins rather thickly clothed with dark brown scales; fringe grayish purple. Petiole of first submarginal cell about as long as the cell, that of the second a little longer. Posterior cross vein about its own length from the mid cross vein.

Described from several freshly bred specimens taken at Nassau, May 10, 1905.

Corethra fuliginosus n. sp.

Female. Proboscis very short, pale yellowish. Palpi fuscous yellow, about three times as long as the proboscis with the third and fifth segments subequal, fourth shorter. Antennae about one half the length of the body, pale yellowish; basal segment subglobular, fuscous internally, others brownish with sparse basal whorls and a scanty clothing of pale yellowish hairs. Occiput rather thickly clothed with purplish brown hairs. Pronotal lobes prominent with lateral tufts of stout hairs. Mesonotum with a narrow median line of short, black hairs and a nearly smooth, subdorsal brown area, narrowing posteriorly. Sublaterally the mesonotum is clothed with long, dark brown hairs, becoming longer posteriorly except for a rather broad sublateral naked space posteriorly. Pleura nearly naked. Scutellum prominent with numerous long, brown apical setae; postscutellum smooth, yellowish with dark brown inverted V. Halteres, basal portion yellowish transparent, apical fuscous. Abdomen a uniform fuscous, sparsely clothed with long, yellowish hairs, ventral surface a fuscous yellow. Coxae pale yellowish. Legs nearly uniform yellowish fuscous. Wings with the costa thickly clothed with dark brown scales, other veins rather thickly ornamented with light brown or straw yellow scales; fringe purplish gray. Petiole of first submarginal cell about one third the length of the cell; that of the second about as long as the cell. Posterior cross vein less than its own length from the mid cross vein.

Described from a freshly bred specimen taken at Nassau N. Y., June 12, 1905.

MORPHOLOGY AND PHYLOGENY

The culicid antennae are normally composed of 14 segments with possibly a rudimentary 15th apparent in a few species. The first segment is subglobular in both sexes and in the female the succeeding ones are relatively simple, each with a basal whorl of stout hairs and usually moderately to thickly clothed with very short, fine hairs. The male antennae have the basal whorl present in the female except that the individual hairs are somewhat more slender and much longer. This sex is recognized at once in all but a very few, by the very long, fine hairs or plumes occurring on segments 2 to 12 inclusive. These latter appear to be nothing but the

very highly developed fine hairs clothing the female antennae. The 13th and 14th segments in the male are much produced, each with a basal whorl of stout setae, and in the case of the 13th with a thick group of plumed hairs. The greater part of this segment is comparatively naked, being clothed only with rather short, sparse hairs. The 14th is sparsely clothed with short hairs. The antennae of Deinocerites are remarkable because of the greatly prolonged second segment in both sexes, it being three times the length of the following segments in the female and on account of all the segments being similarly clothed in both sexes. The male is at once recognized by its having the third to seventh segments also much produced though each shorter than the preceding one. The antennae of Corethrella are peculiar in that the female possesses on segments 2 to 14, a scattering secondary whorl about the middle of each, while in the male there is a distinct basal whorl with a thick vestiture of slightly shorter, finer hairs extending to the apical fourth of each segment. Sayomyia presents a more generalized

FIG. 1 Deinocerites cancer, antennae of male and female, showing all but the basal segment and illustrating the peculiar elongation of segments two to seven in the male and the enormous extension of the second segment in the female, greatly enlarged (Original)

FIG. 2 Corethrella brakeleyi, male and female antennae, much enlarged (Original)

condition in that the antennae are composed of 15 nearly equal segments, each presenting approximately the same characteristics as the other groups. The segments of the male antennae are thickly plumose, approximately equal. They differ from those of the other groups in that the plumes all rise from the thick basal whorl on segments 2 to 14 inclusive, a sparse basal whorl somewhat like that of the female occurring at the base of the 15th segment.

The palpi consist of five segments in both sexes of most Culicidae, except in the females of certain Culicinae, where the rudimentary fifth appears to be wanting, and in some Aedeomyinae where there has been an even greater consolidation of segments. These organs are approximately equally developed in both sexes of the Corethrinae, the first and second segments usually being fused, the others distinct and subequal. The Culicinae present striking differences between the sexes. The palpi of the female having the first and second segments nearly fused, the divisions being indicated only by slight constrictions and usually the partial absence of chitin. The third and fourth segments are well developed, subequal, and the fifth is rudimentary and, in some species, absent. The males have the first and second segments almost completely fused as in the case of the female; the third is enormously produced with a pseudoarticulation near its middle, while the fourth and fifth are well developed, subequal.

Theobald, in his exceedingly valuable work on *Culicidae of the World*, states that in Culex the female palpi are short and three or four jointed, whereas in the male they are long and three jointed, adding that constrictions at the base give the female the appearance of having four or five jointed palpi, and the male as possessing a five jointed organ. The study of the more generalized forms has convinced us that there are, except as stated above, five segments in these organs, and while in most work it may be impractical to count the basal segments, we prefer to apply the same number to homologous segments in the different groups. This procedure gives one a more just appreciation of morphologic changes and has no serious disadvantage, since after some experience, there is very little danger of misapplying the numerals.

Wings. The wings of Culicidae vary widely in character, as has been previously pointed out. Differences in venation are easily seen and frequently prove of considerable service in identifying species, particularly the relative distance between the mid cross vein and posterior cross vein and the proportions obtaining between the two fork cells and their petioles. The male wing is usually recognized by its much longer petioles, sparse scales and the absence of oblique scales along the greater portion of the posterior margin. The scales clothing the wings of these insects vary exceedingly, ranging from almost linear in Sayomyia and Corethra to the lanceolate ones of Anopheles or the very much dilated scales of Uranotaenia. The latter is remarkable for the great diversity in its wing scales. The wing clothing of most Culicids is easily divided into two classes—the long and the short scales, the longer ones being slender, frequently strap-shaped and, as a rule, extending some distance on each side of the veins, while the short scales are

FIG. 3 Culicada fitchii palpus of male and female showing the normal condition for the two sexes, much enlarged (Original)

more or less broadly triangular and generally closely appressed to the vein. The striking variations in scale characters are very well shown by reference to plate 1, figures 2, 3, which illustrates some of the more unique exotic forms supplementing the illustrations of these organs published in Museum Bulletin 79. The wing of our native Theobaldia incidens Thom., [pl. 3, fig. 1], illustrates a marked tendency toward segregation of scales, which is shown even better in the enlargement reproduced at plate 3, figure 3.. The Australian Mucidus alternans Westw. [pl. 1, fig. 2], is another instance of segregation and the peculiar dilated scales are well shown at plate 1, figure 4. The South American Mansonia titillans Walk., has a very striking wing [pl. 1, fig. 1], which is clothed with numerous closely set, dilated, asymmetric scales, some of which are shown much enlarged at plate 1, figure 3. The tendency toward dilated wing scales appears in widely separated individuals, as for example Aedeomyia squammipenna Arrib., the wing of which [pl. 2, fig. 1], presents a peculiar mottled appearance, easily explained when we examine an enlargement thereof [pl. 2, fig. 3]. The rather highly specialized African Eretmapodites quinquevittatus Theo., has a narrow, long wing [pl. 2, fig. 2], with a very peculiar arrangement of the scales shown enlarged at plate 2, figure 4. The extreme in wing elongation is exhibited by the South American Sabethes remipes Wied. [pl. 3, fig. 2], and the general character of its wing scales are well brought out at plate 3, figure 4.

These striking variations in wing structure appear to be rather closely correlated with variations in other organs and are of considerable value in systematic work. The marked divergencies in wing clothing or scales appears to be more erratic and of comparatively little aid in indicating lines of descent though frequently of great value in the recognition of species.

Genitalia. The male genital organs in the Culicidae present remarkable diversities and afford most excellent characters for the grouping of allied species. The large conspicuous lateral organs have been termed the clasps. They are composed of two segments, a large basal one which presents considerable modification in form and bears, particularly in Culex as at present restricted, very characteristic appendages near the apical third, and near the base more or less peculiar chitinous spines usually on an elevation or tubercle. The term claspette is employed to designate certain peculiar and very significant organs occurring

on the ventral surface of this basal segment. Ordinarily the claspette is represented by one or more spined tubercles, but in the extremely generalized Protoculex serratus Theo., this organ is represented by a conspicuous basal spined lobe and a longer, acute one near the apex of the basal segment. This suggests that a still more generalized form may possess clasps and their ventral counterpart, the claspette, more largely developed, and it is possible that in some forms they are approximately equal. There is an approach to this in Wyeomyia smithii Coq. The basal clasp segment consists of two nearly equal chitinous processes connected only by a thin membrane apically and by no means firmly joined basally. The peculiar divided terminal segment is plainly compound and may have been produced by the fusion of two comparatively simple processes. This conception affords a ready explanation for the persistance throughout the group of more or less prominent tubercular elevations on the ventral surface of the clasp segment, and if our interpretation be correct, the degree of development along certain lines at least, will be accurately indicated by this organ.

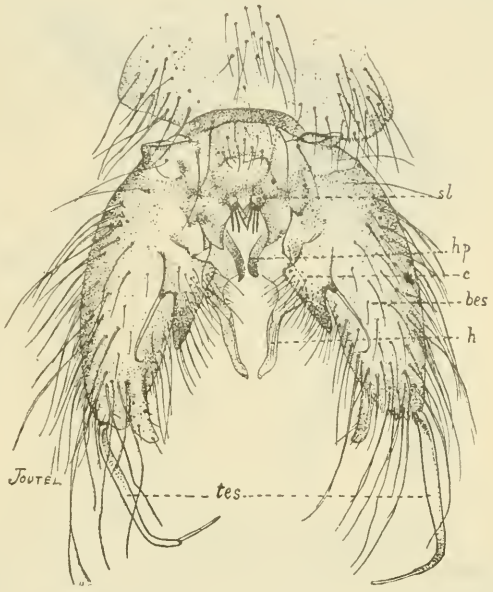


FIG. 4 Protoculex serratus, ventral aspect of male genitalia: *tes*=terminal clasp segment; *bes*=basal clasp segment; *h*=harpes; *hp*=harpago; *c*=claspette; *sl*=setaceous lobes, much enlarged (Original)

The terminal clasp segment is much more slender than the basal one and in some species is very elongate and arcuate. This is particularly true in the Anophelinae. The large majority of forms have at or near the apex of the terminal clasp segment, a more or less developed spine, apparently the rudiment of a ventral second segment and analogous to the claspette of the basal segment. This spine is absent in some forms and double in others. This terminal segment presents considerable morphologic differences and in some forms bears striking appendages, notably in the case

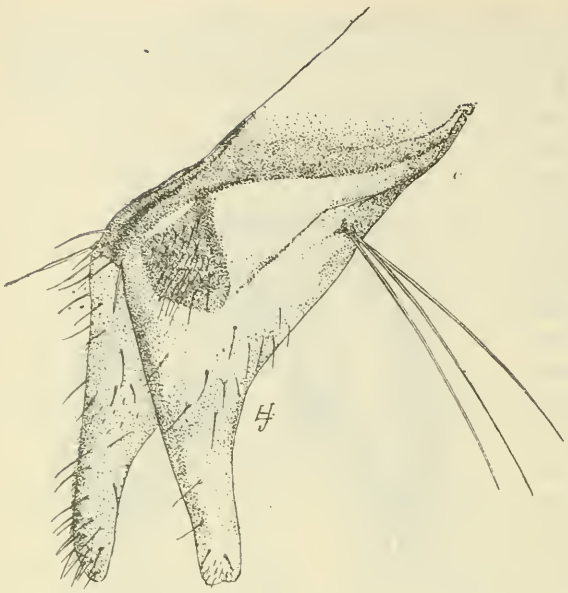


FIG. 5 Wyeomyia smithii, basal clasp segment of the male genitalia, showing its peculiar bifurcate apex, much enlarged (Original)

of the African Taeniorhynchus aurites Theo. [pl. 16, fig. 2]. This structure is very grotesque in Wyeomyia smithii Coq. Another striking modification is seen in our native Grabhamia jamaicensis Theo.

The harpes, lying just within the clasps and originating near their base, are normally next in size. They may easily be recognized in the Culicinae by the pronounced angle frequently present near the more or less perfect fusion of their two segments or pseudosegments. These organs are ventral, submedian, with bases approximate. They are, if we have correctly homologized the parts, highly specialized in the Anophelinae, in which group they are linear, approximate and usually bear several divergent, spiny apical processes. These organs are remarkably diverse in structure and in Culex, as now restricted, are divided. The terminal falcate blade so conspicuous in Culicada appears to arise from near the base of the setaceous proximal portion. This latter is smooth and usually with its apex crowned with a dense series of stout, chitinous spines, very characteristic of Culex, and presumably occurs in all species, though in certain forms, owing to the lack of material we have been unable to identify them with certainty. Their recognition in the less specialized Aedeomyinae is

FIG. 6 Wyeomyia smithii, male genitalia showing the apex of the basal clasp segment bearing the extremely complex terminal clasp segment, much enlarged (Original)

very difficult and they appear to be wanting in many of the Corethrinae.

The harpagones are a pair of smaller clasping organs lying above the harpes and within the base of the clasps. They are usually strongly curved, terminated by a stout, somewhat recurved hook and are attached to the rudimentary eighth segment in some cases at least. These organs in the Anophelinae, if we have correctly homologized the parts, and in certain Culicinae, bear conspicuous

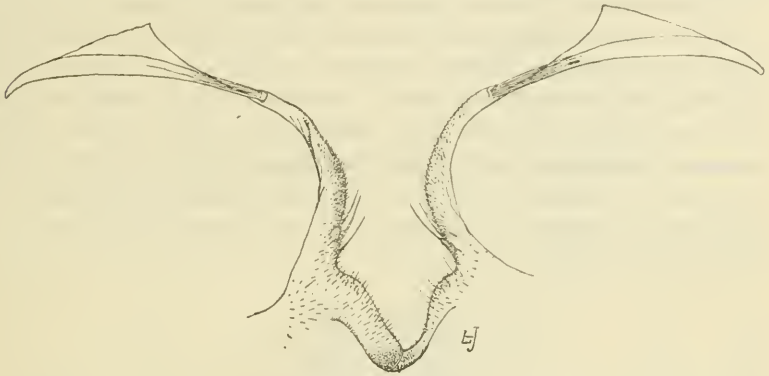


FIG. 7 Culicada subcantans, harpes, much enlarged (Original)

terminal chitinous spines. They are usually divided in Culex proper and in certain species there appear to be more than the normal number of organs on account of this peculiarity. This tendency is well illustrated in Culex annulioris Theo., C. concolor Rob. & Desv. and C. tigripes Grand. This process seems to have gone farther than in our native species, so that without the evidence afforded by these exotic forms it would be difficult to properly homologize the parts.

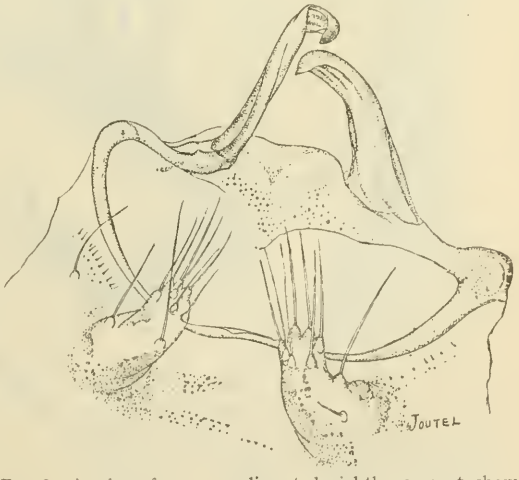


FIG. 8 Aedes fuscus, dissected eighth segment showing the attachment thereto of the setaceous lobes and the harpagones, much enlarged (Original)

The unci, as we have identified them, consist of a pair of processes on the ventral margin and present considerable variations in structure. These organs are readily seen in most of the Culicinae, while

in the Anophelinae they appear to be absent or else their function is usurped by the largely developed tergum which extends back and protects the smaller organs. These structures are weakly chitinized in some species and in others are much stouter and in certain forms are provided with peculiar series of chitinous teeth. This appears quite characteristic of the genus Taeniorhynchus, being particularly well developed in T. brevicellulus Theo. and T. aurites Theo.

The setaceous lobes are peculiar structures apparently belonging with the preceding organs of the ninth segment, but in reality a part of the rudimentary eighth segment. They are in most Culicinae simple, chitinous lobes bearing a series of stout, chitinous spines. In some instances these latter are very stout. A few Culicinae possess submedian groups of similar chitinous spines on the seventh abdominal segment, as in Culiseta absobrinus Felt. C. consobrinus Walk. and Taeniorhynchus perturbans Walk.

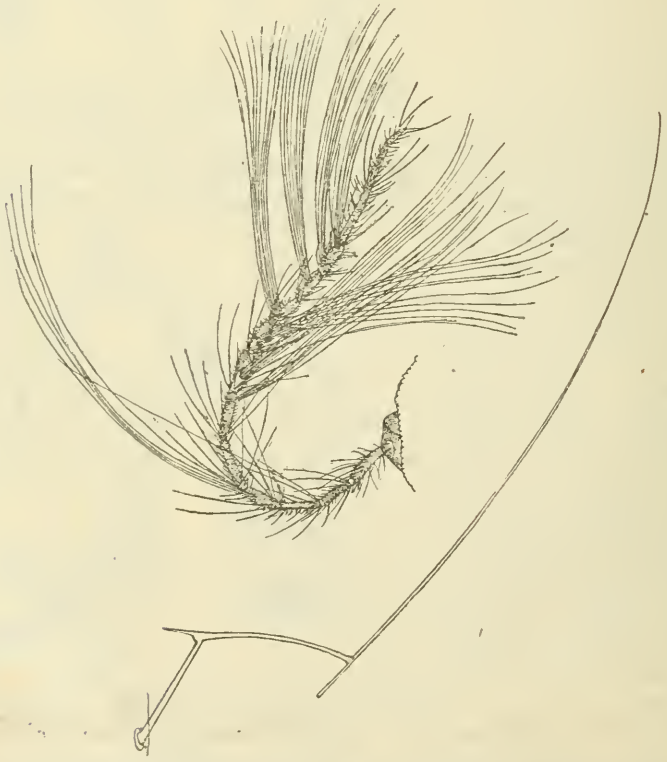


FIG. 9 Culicada aberratus, hermaphrodite antenna showing segmentation characteristic of the female, with the greatly elongated plumes of the male and illustrating a peculiar compound hair occurring on the third segment. Smaller ones are also found on more distal segments much enlarged (Original)

Hermaphrodites. These abnormal forms are rare in the insect world, and a study of the modifications presented is of considerable interest, particularly in groups presenting secondary sexual characters in various organs. Mosquitos are specially interesting in this respect because well defined sexual characteristics are found in the palpi, antennae, wings, claws and terminal abdominal appendages. Owing to the fact that most hermaphrodites in this group resemble either one sex or the other closely, they are rarely detected till after death, and, as a consequence, it is almost impossible to give attention to more than the external characteristics, since internal structures are badly distorted by drying before the unique character of the specimen is recognized. We are not aware of any hermaphrodite mosquitos being described before. A brief characterization of the two following forms will doubtless prove of interest, since they present some peculiar modifications.

Culicada abserratus Felt. The head of this specimen presents a well marked lateral division, the right side being male, the left female. The male antenna appears to be practically normal for that sex, while the other shows a marked male influence in the enormous prolongation of the basal whorls of each segment and particularly in the greatly extended 14th and 15th segments. The male or right palp appears to be normal for that sex, while the left or female palp shows a decided tendency toward the male form in that the terminal or fifth segment is as long as either the third or fourth, while in the normal female this segment is reduced to a mere rudiment. Unfortunately the wings from the two sides of this specimen were not carefully labeled when mounted. What is probably the wing from the right side, is a little narrower than the other. The submarginal cells have slightly longer petioles, the posterior cross vein is somewhat more remote from the mid cross vein and the scaling is also distinctly thinner, all characters indicating a male influence in the right wing, though this organ has the oblique fringe scales, so characteristic of the female, well developed along the posterior margin. The left wing presents practically every character of the normal female. This identification of the wings is borne out by an examination of the legs, the right fore leg presenting a distinctly male character in that the claws are decidedly unequal. The mid and posterior claws are equal and the same is true of all three of the legs from the left side.

FIG. 10 Culicada abserratus, hermaphrodite palpus showing the fifth segment nearly the same size as the third and fourth, a distinct tendency toward the condition found in the opposite sex, much enlarged (Original)

The most striking modification is seen in the abdominal appendages, the clasp, terminal clasp segment and harpes of the right side being well developed and distinctly male. The right harpago appears to be present, though it has become fused with another organ, possibly a rudimentary female lobe. The setaceous lobes, also characteristic of the male, are both well developed. Most of the organs on the left side are rudimentary and may be possibly regarded as very much reduced male appendages or probably distorted female lobes.

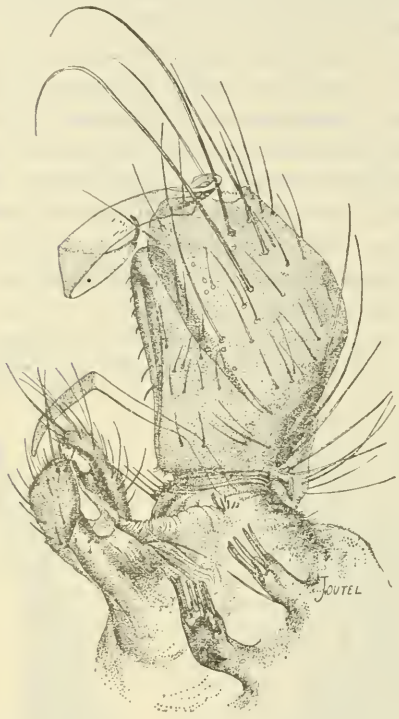


FIG. 11 Culicada aberratus, genitalia of an hermaphrodite.

It will be seen by reference to the above that this specimen is largely male on its right half, with a sinister preponderance of female characters.

Culicada pullatus Coq. The right antenna of this specimen is characteristically male, while the left is plainly female with male tendencies shown in the enormous prolongation of the basal whorls of each segment and the somewhat slightly produced 13th and 14th segments. Both palpi are plainly male. The right wing has the sparse scale clothing of the male, with the posterior cross vein remote from the mid cross vein, the absence of oblique fringe scales and a greatly produced anal angle; the left wing is narrower than the other, with an even greater distance between the posterior and mid cross veins and the submarginal cells, with possibly slightly longer petioles than in the other wing. The left wing presents a marked female characteristic in the presence of oblique fringe scales near the posterior margin, and it is possible that these structures were along the greater length of the wing and have been lost by abrasion. The fore and mid legs of the right side present a striking male modification in the very obvious inequality between the claws, a character present in almost equal degree in the fore leg of the left side and nearly absent in the claw of the right mid leg. The wings and legs of the two sides it will be seen, plainly indicate an intermingling of the characters of the two sexes. The posterior abdominal appendages are remarkable in that they are obviously female and apparently entirely normal for this species.

It will be seen by reference to the above that there is a partial lateral division and a plain anteroposterior sexual modification in that the head is largely male, while the posterior extremity is apparently entirely female.

ANOPHELINAE

A study of the genitalia of a number of species placed in this subfamily, shows it to be a natural group possessing marked structural characteristics as follows. The terminal clasp segment is extremely elongate, slender and arcuate. The harpes are remarkably modified in most of the species studied, being approximate, slender and tipped with several divergent, acute spines. This is true of all the species studied except the exceedingly peculiar Jamaican Cycloleppteron grabhamii Theo., which diverges remarkably from other members of the group in its extremely highly specialized ovate wing scales. The Anopheline harpagones are peculiar in being composed of a broad, usually subtriangular basal part bearing several stout spines in sharp contradistinction to the characters presented by these organs in the Culicinae. The Jamaican and South American Cellia albipes Theo., is another divergent form in that the third longitudinal vein terminates at the cross veins, whereas in other species studied by us it continues beyond. The larva of this form also presents some striking peculiarities, among which may be mentioned the absence of the slender apical setae on the antennae, though the two stout conic processes are present as in most Anopheline larvae. The larvae as a whole comprise specialized forms widely divergent from the ordinary culicid type. The young of this group are easily recognized by the extremely short air tube and the peculiar platelike comb with its posterior fringe of stout sometimes serrulate spines.

FIG. 12 Culicada pullatus, hermaphrodite antenna showing a distinct elongation in the four terminal segments and with the long plumes characteristic of the male, much enlarged (Original)

Anopheles punctipennis Say. *Genitalia, male.* Basal clasp segment stout, evenly rounded, apical segment long, slender, arcuate and bearing a small stout spur. Claspette a rather large basal lobe bearing two stout spines, the inner being larger. At the apical third there is another conspicuous stout spine. Harpes slender, fused and tipped with two clusters of about three uneven spines. Harpagones, basal portion subtriangular, apical portion tuberculate and bearing several stout, chitinous spines, the two outer being near together and larger than the more widely separated, smaller

inner ones. Tergum slender, greatly extended beyond the harpes and harpagones. Lobes of eighth segment stout, slightly tapering, obliquely pointed, naked processes.

Anopheles maculipennis Meig. *Genitalia, male.* Basal clasp segment stout, evenly rounded. Terminal clasp segment slender, arcuate, bearing a short, stout apical spine. Claspette a moderately developed basal lobe bearing two, long chitinous spines. There is also a large, chitinous spine at the inner apical third of the basal lobe. Harpes slender, fused, with two apical groups of three stout spines. Harpagones, basal portion irregularly triangular, apical portion consisting of an outer long, slender, fingerlike process and a pair of inner chitinous, acute spines, the inner one of the pair being longer than the other. Tergum slender, extending beyond the harpes and harpagones. Lobes of eighth segment slightly capitate with naked, acute tips.

Cellia albipes Theo. *Genitalia, male.* Basal clasp segment rather slender, apex broadly rounded. Terminal clasp segment long, slender, arcuate, slightly enlarged at both extremities, the apex bearing a rather stout spine. Claspette represented by a conspicuous basal lobe and a larger one near the middle, the former bearing one and the latter two large chitinous spines with acute, recurved tips. Harpes long, slender, fused, apex broadly rounded, expanded. Harpagones with base broadly expanded, somewhat triangular, the apical portion bearing a pair of stout, slightly curved, chitinous processes with acute tips. Tergum slender, greatly extended beyond the harpes. Lobes of eighth segment indeterminate. [Pl. 4, fig. 1]

Cycloleppteron grabhamii Theo. *Genitalia, male.* Basal clasp segment stout, with a rather broadly rounded apex. Terminal clasp segment long, slender, arcuate, base and apex slightly enlarged, the latter bearing a short, stout apical spur. Claspette a bilobed basal elevation on the first clasp segment, each lobe bearing a large, chitinous spine with an acute, recurved tip The basal clasp segment also bears a prominent chitinous spine at the internal third. Harpes very slender, approximate, each with a pair of acute, spinelike processes at its apex. Harpagones, basal portion broad, triangular, apical part a slender, acute, chitinous spine. At the extreme base there is a tubercular elevation bearing a conspicuous spine, possibly a lobe of the harpagones, though it may prove to be one of several minor basal spine-bearing elevations on the first clasp segment. Tergum large, fused and extending beyond the harpes and the harpagones. Lobes of eighth segment slender, smooth, fingerlike, with apex rounded. [Pl. 4, fig. 2]

Nyssorhynchus jamesii Theo. *Genitalia, male.* Basal clasp segment stout with a rather broadly rounded apex. Terminal clasp segment long, slender, arcuate, base and terminal portion slightly enlarged, the latter bearing a rather small, stout terminal spine. Claspette apparently represented by a single stout, curved ventral spine. Harpes very slender, approximate, each with about three divergent, acute processes. Basal portion of harpagones broadly rounded and bearing at the apex a stout, fingerlike, chit-

inous process with rounded extremity, evidently composed of several chitinous spines fused together. Internally there are several stout, chitinous spines. Unci long, very slender, fused and extending beyond the harpes and harpagones. Lobe of eighth segment broad, short, smooth, with apex obliquely rounded.

Pyretophorus costalis Loew. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a broadly rounded apex. Terminal clasp segment very long, slender, arcuate, basal portion enlarged and with a small, stout apical tooth. Claspette much reduced, apparently represented only by a rather irregular ventral group of large, chitinous spines. Harpes approximate, linear, each with three or four acute, serrate, triangular, divergent processes. Basal portion of harpagones subquadrangular, excavated internally, with a rather stout, recurved tooth. On the apical external margin there is a stout, slightly curved, chitinous process rounded apically evidently composed of several fused, chitinous spines. Close beside this there is a small, chitinous spine and a larger and a smaller one internally. Tergum large, membranous and extending beyond the harpes and harpagones. Lobes of eighth segment indeterminate. [Pl. 5, fig. 1]

CULICINAE

Psorophora ciliata Abr. *Genitalia, male.* Basal clasp segment stout, slightly rounded and tapered posteriorly. Terminal segment excurved, with subapical outer and terminal inner spine; inner convex margin armed with a series of stout, spine-tipped teeth. Claspette inconspicuous. Basal segment of harpes incurved, nearly acute at tip and bearing many terminal and subterminal, recurved hairs, and with a subapical, falcate appendage externally, the basal portion when in normal position, forming an almost complete circle. Harpes regularly curved and crowned exteriorly with a series of stout teeth. Unci nearly approximate, parallel, convolute, one corner being folded back and forming a broad, retrorse spine. Setaceous lobes of ninth segment rudimentary.

Janthinosoma musica Say. *Genitalia, male.* Basal clasp segment stout, tapering, with a well defined apical lobe; middle of teiminal segment enormously dilated, apex bearing a short, stout, sprne. Claspette represented by a rudimentary lobe. Harpes long, slender, slightly incurved and with a conspicuous internal brush of long hairs on the apical third, and at the extreme tip a pair of somewhat spatulate, sucker-disklike appendages, which appear to be composed in part of a delicate, convoluted, broad strip of chitin. Harpagones broad, with a stout, terminal, recurved spine and several smaller chitinous spurs. Unci approximate, tapering, with the acute tips appressed. Setaceous lobes of ninth segment rudimentary.

Janthinosoma lutzii Theo. *Genitalia, male.* Clasp and claspette very similar to those of the preceding species. The harpes differ mainly in the shorter, internal brush of long hairs and also by a more marked discrepancy in the pair of apical organs, each of which distinctly shows a loose spiral of tapering, chitinous tissue.

Harpagones very similar to those of the preceding species. Unci shorter and apparently fused and projecting from under the dorsal plate, which latter bears mesally a series of stout spines along its posterior margin. [Pl. 5, fig. 2]

Grabhamia Theo. This genus was erected by Theobald,[1] and in listing the species referred thereto he names first d o r s a l i s Meig., and in his account of species gives first place to j a m a i c e n s i s. Correspondence developed the fact that he considered this latter species the generic type and accordingly we adopted it.[2] Dr Dyar[3] took d o r s a l i s Meig. as the type of Grabhamia and erected a new genus Feltidia with j a m a i c e n s i s as its type. Under the conditions we prefer to accept Theobald's subsequent designation of the type as authoritative and consider Feltidia a synonym of Grabhamia, retaining Culicada Felt as a valid genus.

Grabhamia jamaicensis Theo. *Genitalia, male.* Basal clasp segment stout, tapering slightly and with a well defined apical lobe. Terminal segment enormously dilated in the middle and with a short, stout, apical spur. Claspette a rather prominent lobe bearing about six stout, broad, chitinous processes and located about the middle on the basal segment. Harpes apparently absent; harpagones[4] stout, curved, with a prominent retrorse spine and several stout apical teeth. Unci approximate, slightly convolute, with rounded apexes. Setaceous lobes slightly developed, each consisting of a long, dark, chitinous ridge each side of the median line, margined posteriorly with numerous very fine spines.

Grabhamia discolor Coq. *Genitalia, male.* Basal clasp segment short, stout, apex rounded and with a slight indication of an apical lobe. Terminal segment enormously dilated in the middle and with a short, stout, apical spur. Claspette a prominent lobe bearing several stout, chitinous processes located just before the middle of the basal clasp segment. Harpes apparently absent; harpagones curved, with a rather prominent, slightly recurved hook and several stout, apical spurs. Unci approximate, tapering to a rounded tip. Setaceous lobes of ninth segment similar in character, though less developed, than in G. j a m a i c e n s i s. [Pl. 6, fig. 1]

Desvoidea panalectros Theo. *Genitalia, male.* Basal clasp segment stout, conic, tapering gradually to a rounded apex. Terminal clasp segment stout, arcuate and with a series of stout spines along the inner margin of the apical two thirds. Claspette represented by an inconspicuous basal fold bearing two stout chitinous spines. Harpes apparently represented by a pair of rather stout, broad, flattened processes, tapering gradually to a rounded apex. Harpagones short, stout, terminating in an acute, recurved, blunt spine. Unci closely appressed, somewhat curved with both ventral and dorsal margin and apex strongly serrate. Setaceous lobes indeterminate. [Pl. 6, fig. 2]

[1] 1903 Theobald, F. V. Monograph of the Culicidae or Mosquitos, 3:243.
[2] 1904 Felt, E. P. N. Y. State Mus. Bul. 79, p. 391*b*.
[3] 1905 Dyar, H. G. Ent. Soc. Wash. Proc. 7:48
[4] Further study leads us to believe that the harpes, rather than the harpagones, are the missing organs. *See* N. Y. State Museum Bulletin 79, p. 391*b*.

Desvoidea obturans Walk. *Genitalia, male.* Basal clasp segment stout, conic, tapering gradually to a rounded apex. Terminal clasp segment rather stout, strongly curved and with a series of stout spines occurring along the inner margin of the apical half. Claspette an inconspicuous basal lobe bearing several stout spines. Harpes rather stout, tapering to a somewhat rounded apex. Harpagones short, stout, terminating in a stout, recurved spine. Unci approximate with dorsal, ventral and apical margins strongly serrate. Setaceous lobes indeterminate.

The genus Desvoidea presents some extraordinary characters in the genitalia. The terminal clasp segment is remarkable because of the series of stout, chitinous spines along a considerable proportion of its inner margin and the unci are unique in that they appear to be composed of a series of fused, stout, chitinous processes, giving the free margins a strongly serrate character.

Mucidus alternans Westw. *Genitalia, male.* Basal clasp segment stout, gently rounded exteriorly to a more or less rounded or oblique apex. Terminal clasp segment strongly curved, slender and bearing a stout, rather long apical spine. Claspette a rather conspicuous basal lobe bearing a number of coarse setae and one or more stout, chitinous spines. Harpes long, slender, basal portion short, apical part strongly curved, terminating in an acute point. Harpagones rather long, slender, terminating in a stout, recurved spine. Unci approximate, slender, with a broadly rounded apex. Setaceous lobes apparently rudimentary, though the stout setae normally occurring, are present. [Pl. 7 fig. 1]

Culicelsa taeniorhynchus Wied. *Genitalia, male.* Basal clasp segment stout, rather long, slightly tapering to a somewhat rounded apex. Terminal segment slightly swollen in the middle and with a long apical spur. Claspette a prominent internal lobe at the basal third, bearing numerous long setae. Harpes long, basal portion setaceous, incurved; apical naked and with a prominent retrorse, exterior spine. Harpagones regularly curved, ending in an acute, external spine. Unci broad, approximate, with rounded apex. Setaceous lobes of ninth segment slightly developed, each bearing a number of stout spines.

Culicelsa aurifer Coq. *Genitalia, male.* Basal clasp segment rather stout, with distinct apical lobe, and at its extremity a peculiar, thick tuft of long scales or hairs. Terminal segment slender, slightly swollen in the middle and with a long, stout apical spine. Claspette a prominent internal process near the middle, bearing a falcate, chitinous spine. Harpes long, slightly curved inwardly, basal portion setaceous, apical part terminating in a large bladelike structure with a short, external retrorse spine. Harpagones curved, with an external terminal spine and a number of peculiar, short, external setae about their middle. Unci long, slightly separated, the apex subacute. Setaceous lobes well developed, each crowned with about six long, stout spines.

Female. Lobes about four times as long as broad, tapering abruptly beyond the middle. Apex rounded, with a few somewhat stout hairs. Ventral plate about two thirds the width of a lobe, deeply emarginate apically.

Culicada canadensis Theo. *Genitalia, male.* Basal clasp segment stout, slightly tapering and rounded apically and with a small apical lobe. Terminal segment rather slender, curved, and with a slender, long, apical spine. Claspette a conspicuous, setaceous lobe at the basal third. Harpes with basal portion stout, slightly enlarged at distal third, where there are several stout, internal spines; apical portion slender, tapering gradually to a rounded point and strongly bent outwardly at the basal fourth. Harpagones stout, strongly curved and ending in a stout, recurved spine. Unci broad, approximate, rounded apically. Setaceous lobes approximate, moderate in size and bearing about eight stout, chitinous spines.

Female. Lobes rather stout, nearly five times as long as broad, gently rounded exteriorly to a somewhat acute point. Apex with a number of somewhat stout hairs. Ventral plate as wide as a lobe, extending to basal third and slightly emarginate apically.

Culicada subcantans n. sp. *Genitalia, male.* Basal clasp segment stout, sides nearly parallel, tapering somewhat distally and with a well developed distal lobe. Terminal segment slender, slightly swollen near the middle and with a long, slender, apical spine. Claspette a slight basal lobe bearing a very long curved, chitinous spine and a few large setae. Harpes with the proximal portion stout, and at the basal third several large, internal spines; distal portion a very long, slender, halbert-like blade, with a slightly recurved, acute tip. Harpagones evenly rounded, terminating in a stout, recurved tooth and with several smaller teeth. Unci approximate, rather broad, apex acute. Setaceous lobes well developed and bearing numerous large, chitinous spines. [Pl. 7, fig. 2]

Female. Lobes stout, about four times as long as broad, gently rounded exteriorly to a rather broadly rounded apex bearing a number of stout setae. Ventral plate as broad as a lobe, extending slightly beyond the basal third; apically, strongly emarginate and with a slightly sinuate lateral margin.

Culicada cantans Meig. *Genitalia, male.* Basal clasp segment rather stout, slightly broader apically and distinctly lobed. Basal portion with a conspicuous triangular internal lobe on the ventral margin. This is clothed with coarse setae and tipped with a brush of long hairs, those from the lobe of one side intermingling with those from the lobe on the other. A pair of very characteristic long setae arises from just before the apex of the basal segment. Terminal segment slender, slightly curved, swollen near the middle and bearing a long, slender, rather stout apical spine. Claspette represented by a dark, triangular elevation at the base of the triangular lobe described above. A stout, curved spine arises at its larger lateral end and many smaller fine setae spring from along

the entire length of its crest. Harpes, basal portion finely setose, extreme base broadly expanded; terminal portion smooth, falcate, irregularly curved. Harpagones stout, strongly curved, tapering in a large, recurved, chitinous tooth. Unci short, tapering rather quickly to nearly oblique points. Setaceous lobes well developed and bearing six or more stout setae. [Pl. 8, fig. 1]

Described from a specimen kindly contributed by Dr F. Meinert of Copenhagen, Denmark, who states that it was from Staeger's old collection.

A male of this species kindly sent us by Dr F. Meinert of Copenhagen, Denmark, shows that the above named American species noticed by Dr Smith and the writer, under the name of Culex cantans Meig., is a different species. There is considerable similarity between the genitalia of our American species and the European form, yet they are readily separated by the conspicuous linear, oblique, setaceous lobe at the base of the first clasp segment and in particular by the conspicuous prolongation of the inner ventral wall into a tapering process with rounded extremity, which nearly meets the one arising on the opposite segment. The narrow setaceous lobe previously mentioned has a peculiar curved spine at its lateral extremity, and its posterior margin is thickly clothed with stiff setae. The ventral surface of the conspicuous basal lobe is also thickly clothed with setae and its apex bears a thick brush which intermingles with that arising from the process on the opposite side.

Culicada fitchii Felt. *Genitalia, male.* Basal clasp segment stout, slightly prolonged, obliquely truncate apically. Terminal segment slender, slightly curved at the distal fourth and bearing a long apical spine. Claspette represented by a conspicuous conical basal lobe thickly clothed with rather coarse setae, there being no stout, chitinous spines. There is also a conspicuous rounded subapical lobe on the basal clasp segment. Harpes with the basal portion hairy, long, gently curved, the apical part smooth, bladelike, somewhat expanded near the middle and strongly curved. Harpagones stout, curved, ending in a stout, recurved, chitinous spine. Unci apparently fused, slender, rounded exteriorly and terminating in a pair of somewhat rounded, slightly separated points. Setaceous lobes moderately developed each bearing about five stout, chitinous spines. [Pl. 8, fig. 2]

Female. Lobes stout, about four times as long as broad, slightly swollen near the middle, curving gradually to a somewhat rounded apex bearing a few slightly stouter setae. Ventral plate about as wide as a lobe, extending beyond the basal third; apically, slightly emarginate; lateral margin somewhat oblique.

Culicada abfitchii Felt. *Genitalia, male.* Basal clasp segment moderately long, stout, apex narrowly rounded and bearing two very large, stout setae and numerous smaller ones. Terminal clasp

segment rather slender, strongly curved at the apical third and bearing a long, slightly curved apical spine. Claspette an inconspicuous tubercular setose basal enlargement with a stout, chitinous spine at its ventral margin. There is also a large, setaceous subapical lobe on the ventral segment. Harpes quite long, the setose basal portion extending to the middle of the basal clasp segment; apical portion smooth, bladelike and usually with a pronounced angle on its posterior edge. Harpagones stout, curved and terminating in a stout, recurved, chitinous spine. Unci fused, expanded anteriorly, gently tapering posteriorly to obliquely rounded dentate apexes separated by a broadly excavated space. Setaceous lobes well developed and bearing six or seven stout, chitinous spines.

The structure of these organs appears to be somewhat variable in this species, this being particularly true of the claspette, which appears to be rudimentary in some individuals and also of the terminal portion of the harpes, which is apparently quite variable in length. [Pl. 9, fig. 1]

Female. Lobes scarcely four times as long as broad, wider at the basal third and rounding gently therefrom to the somewhat acute apex bearing a few stout setae. Ventral plate as wide as a lobe, deeply emarginate apically and with a sinuate lateral margin.

Culicada annulifera Lud. *Genitalia, male.* Basal clasp segment moderately stout, gently curved with broadly rounded apex. Terminal clasp segment slender, gradually curving at the apical third to a long, rather stout terminal spine. Claspette a conspicuous tuberculate basal lobe bearing numerous stout setae. There are also two stout subapical setae internally. Harpes slender, basal portion setaceous, apical naked, slender and tapering to an extremely acute tip. Harpagones stout, slightly expanded at the apex and with an almost recurved, acute apical spine. Unci slender, approximate, tapering to an acute apex. Setaceous lobes well produced, with five or six stout apical spines.

Culicada confirmatus Theo. *Genitalia, male.* Basal clasp segment stout, long, with a broadly rounded apex. Terminal clasp segment rather stout, slightly swollen near the middle and with a long, stout terminal spine. Claspette an inconspicuous basal setaceous lobe bearing a very large, chitinous spine somewhat swollen near the base and tapering gradually to a very fine, recurved point. Harpes with basal portion setose, slender, apical part smooth, falcate and with a slight, recurved, blunt tip. Harpagones stout, curved and with a strongly recurved, acute tip. Setaceous lobes well developed, each with about eight stout, chitinous spines. Unci slender, approximate, rounding gradually to an acute apex. [Pl. 9, fig. 2]

Culicada cantator Coq. *Genitalia, male.* Basal clasp segment stout, rather long, with conspicuous apical lobe. Terminal segment slender, curved, and with a long, rather stout apical spine. Claspette a rather conspicuous, basal, setaceous lobe bearing one very long, stout, recurved spine, a shorter and numerous smaller ones. Harpes with basal portion rather stout, setaceous, a few

larger internal setae at basal third; apical portion strongly curved, somewhat falcate, apex acute and slightly recurved. Harpagones curved, stout, with a recurved, acute tip. Unci rather broad, approximate at base, acute distally. Setaceous lobes well developed, moderately separated, each with numerous stout, chitinous spines.

Female. Lobes stout and over three times as long as broad, curving gently from the basal third to the somewhat acute, rounded apex bearing a few stout setae. Ventral plate extending to the middle of the lobes, slightly emarginate apically.

Culicada sollicitans Walk. *Genitalia, male.* Basal clasp segment stout, tapering slightly to a rounded apex. Terminal segment rather slender, slightly swollen near the middle and with a stout, rather long, apical spine. Claspette a setaceous basal prominence. Harpes with basal portion rather stout, setaceous, and with a conspicuous, subapical process and spine; distal portion smooth, falcate, with the rounded point recurved. Harpagones stout, curved, with an acute, recurved spine. Unci broad, slightly tapering posteriorly to a nearly obtuse apex. Setaceous lobes moderate, distinctly separated, each with several stout, chitinous spines.

Culicada currei Coq. *Genitalia, male.* Basal clasp segment stout, tapering slightly to a rounded apex. Terminal segment rather slender, slightly swollen near the middle and with a stout, rather long apical spine. Claspette a setaceous basal process. Harpes, basal portion rather stout, setaceous and with a small subapical setaceous process. Distal portion smooth, irregularly falcate, being decidedly broader near the middle of its length. Tip strongly recurved, nearly acute. Harpagones stout, curved, with an acute, recurved spine. Unci broad, rounding to a nearly obtuse apex. Setaceous lobes well developed and crowned with 4-6 stout, chitinous spines. [Pl. 10, fig. 1]

Culicada atropalpus Coq. *Genitalia, male.* Basal clasp segment stout, gently rounded to a rather narrow apex. Terminal clasp segment slender, arcuate, with a rather stout, long, apical spine. Claspette a rather small basal lobe bearing numerous stout setae. Harpes with basal portion setaceous, a stout seta near the distal fourth; apical portion gently curved, bladelike, with a slightly recurved, acute tip. Harpagones stout, curved, with a strong, recurved hook. Unci broad, approximate, distal portion rounded. Setaceous lobes apparently wanting.

Culicada triseriatus Say. *Genitalia, male.* Basal clasp segment stout, gently rounded to a slender apex. Terminal segment short, rather stout, slightly curved and with a long, rather stout, apical spine. Claspette apparently wanting. Harpes with basal portion setaceous, a rather prominent spine near distal fourth; apical portion bladelike, gently curved to an acute point. Harpagones strongly curved, with a stout, recurved terminal spine. Unci broad, fused, with rounded apex. Setaceous lobes small, with two or three stout, chitinous spines.

Culicada trichurus Dyar. *Genitalia, male.* Basal clasp segment stout, arcuate, with distinct terminal lobes. Distal segment rather slender, slightly swollen, at basal third, curved, and with a long, rather stout, terminal spine. Claspette a distinct, basal, triangular, setaceous lobe bearing several very long, stout spines. Harpes with basal portion strongly curved, thickly setaceous; apical part smooth, very irregular, apparently convoluted apically and terminated by a very long, slender spine. Harpagones stout, curved, with a strong, recurved spine. Unci slender, somewhat separated and tapering, with the apex oblique, serrate, and the acute tip with a prominent tooth. Setaceous lobes well developed, widely separated and bearing numerous stout, chitinous spines.

Female. Lobes a little over three times as long as broad, curving on both sides to the somewhat broadly rounded apex bearing a few stout setae. Ventral plate a little broader than a lobe, reaching about to the middle, very slightly emarginate apically. This organ has a somewhat characteristic series of transverse rows of moderately stout setae besides the larger apical and subapical ones observed in most species.

Culicada impiger Walk. *Genitalia, male.* Basal clasp segment stout, slightly curved, with a distinct apical lobe. Terminal segment rather stout, slightly swollen at basal third and with a long, rather stout apical spine. Claspette a basal, internal lobe bearing a pair of long, stout, curved spines. Harpes with basal portion stout, setose, with two large, internal spines and a larger, terminal one; terminal portion subapical, smooth, basal part simple, bearing a terminal, falcate structure with an acute, recurved tip. Harpagones stout, curved, with a strong, recurved hook, also conspicuous internal setae. Unci contiguous and broad at base, apical portion distant, obliquely rounded and terminated by an acute spine. Setaceous lobes medium, bearing numerous stout, acute spines.

Female. Lobes a little over three times as long as broad, tapering or curving gradually from near the base to the rather broadly rounded apex bearing a few stout setae. Ventral plate as wide as a lobe, extending to the basal third and deeply emarginate apically.

Culicada lazarensis Felt & Young. *Genitalia, male.* Basal clasp segment stout, slightly curved and with a distinct apical lobe. Terminal segment slender, curved, and with a stout, long apical spine. Claspette a conspicuous basal lobe bearing numerous small setae. Harpes, basal portion setaceous, with several stout, internal spines at basal third; apical part simple and bearing a rather broad, nearly straight, falcate blade with an external recurved hook. Harpagones stout, curved, and with a strong, recurved hook. Unci approximate, broad at base and tapering apically to widely separated, rounded tips. Setaceous lobes large, well separated and bearing numerous strong spines.

Culicada pullatus Coq. *Genitalia, male.* Basal clasp segment slightly curved, with strongly developed apical lobe. Terminal segment rather stout, slightly swollen at the basal third and with a

long, rather slender, apical spine. Claspette a conspicuous basal lobe bearing a very large, stout spine with a recurved tip. Harpes, basal portion setaceous, proximal strongly angulate; apical part smooth, simple, bearing a broad, bladelike structure with an acute, recurved tip. Harpagones stout, curved apically, and with a strong, recurved apical tooth and one or two smaller, subapical teeth. Unci broad at base, contiguous; apical margin oblique, terminating in an acute tooth. Setaceous lobes distant, bearing about five or six stout, chitinous spines. [Pl. 10, fig. 2]

Culicada abserratus Felt & Young. *Genitalia, male.* Basal clasp segment stout, rather long, slightly expanded apically and with four or five very long, stout, subapical setae and numerous smaller ones. Terminal clasp segment rather long, strongly curved at apical third and bearing a long, slender, apical spine. Claspette represented by a conspicuous subquadrangular basal lobe tipped with numerous long setae and a conspicuous subapical lobe, the latter clothed with short setae. Harpes with a long, slender, simple, hairy basal segment, the apical portion smooth, bladelike, considerably expanded near its base and tapering to a rounded point. Harpagones short, strongly curved, ending in an acute, nearly recurved, chitinous spine. Unci slender, approximate, rounding posteriorly to acute, somewhat distant tips. Setaceous lobes very long, bearing four or five stout, acute, chitinous spines, one or two markedly stouter than their fellows. [Pl. 11, fig. 1]

Female. Lobes nearly five times as long as broad, tapering or curving gradually from near the base to the somewhat acute apex bearing a number of stout setae. Ventral plate nearly as wide as a lobe, extending to the basal third and slightly emarginate apically.

Culicada dupreei Coq. *Genitalia, male.* Basal clasp segment rather stout, tapering slightly to a rounded apex. Terminal segment rather stout, slightly swollen at basal third and with a long, slender, apical spine. Claspette represented by a basal, setaceous elevation bearing several very long spines. Harpes with basal portion strongly curved and coarsely setose, specially apically; terminal portion subapical, simple and bearing a slightly curved, falcate structure. Harpagones stout, curved, with a strong, recurved apical tooth. Unci rather broad, approximate, with rounded distal margin. Setaceous lobes well separated, moderate in size and with two or three conspicuous spines. [Pl. 11, fig. 2]

Ecculex sylvestris Theo. *Genitalia, male.* Basal clasp segment broad, proximal slender, slightly rounded distally. Terminal segment rather stout, slightly expanded, and on account of the rather stout, subapical spine, furcate distally. Claspette apparently unrepresented. Harpe a strap-shaped, setaceous process with numerous long, apical setae. Harpagones flattened, curved, with a slightly recurved, stout, apical spine. Unci approximate, slender, strongly curved, divided apically and ending in three or four stout, recurved spines. Setaceous lobes rudimentary, bearing a few medium setae.

Culicella dyari Coq. *Genitalia, male.* Basal clasp segment stout, tapering to a rather narrow, rounded apex. Terminal segment stout,

tapering gradually and with a short, stout, apical spine. Claspette a prominent basal lobe bearing a conspicuous, stout, apical spine. Harpes apparently absent; harpagones strongly recurved, each with a large and a small tooth. Unci prominent, broad, fused, terminating posteriorly in a rounded, perforated process. Setaceous lobes not produced, bearing about seven stout setae.

Culicella melanurus Coq. *Genitalia, male.* Basal clasp segment stout, tapering to a rounded apex. Terminal segment slender, tapering slightly and with a rather short, stout, apical spur. Claspette a rather conspicuous basal lobe bearing a number of stout setae. Harpes apparently absent; harpagones curved, strongly recurved, each with a larger and two smaller, recurved teeth. Unci broad, separated anteriorly, posteriorly rounded, inner edges appressed though not fused. Setaceous lobes not produced, each bearing a number of stout spines.

Female. Lobes broadly rounded, apparently attached dorsally, with the nearly circular margin of the free end ventral. Tergum produced beyond the lobes, broadly rounded. Posterior margin of the seventh abdominal segment fringed with a series of very stout, long spines.

Theobaldia annulata Meig. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a rather broadly rounded apex. Terminal clasp segment slightly enlarged at the base, rather strongly curved and with a short, stout apical spine. Claspette a rather conspicuous basal lobe bearing a number of stout setae and several strong apical spines. Harpes stout with broadly expanded base, the apical portion dilated, strongly spined and ending in one or two stout, chitinous spurs. There is a peculiar sensory organ on the neck of the harpes or just before its distal expansion. It is an oval, elevated area with a number of clear spots, from each of which arises a stout seta. Harpagones wanting. Unci stout, rather slender, somewhat acute apically. Setaceous lobes slightly developed and bearing numerous long, rather slender setae. [Pl. 12, fig. 2]

Theobaldia incidens Thom. *Genitalia, male.* Basal clasp segment stout, somewhat elongate, obliquely truncate to a rather acute apex. Terminal clasp segment rather slender, tapering gradually from the slightly expanded base and bearing a rather long, slender apical spine. Claspette with a rather conspicuous basal lobe bearing two stout apical setae. There is, in addition, a somewhat prominent subapical setaceous process armed with several stout setae, suggesting the very characteristic group of apppendages in Culex proper. Harpe elongate, slender, with apex slightly expanded and divided into two major apical teeth and one or two smaller subapical ones. The peculiar sensory organ observed in T. annulata Meig. is more strongly developed in this species, being a conspicuous oval or subglobular elevation crowned with numerous stout setae. Harpagones wanting. Unci approximate, convolute, ventral margin broadly rounded and tapering to a truncate posterior edge with a conspicuous spine laterally. Setaceous lobes weakly developed, each with about seven rather slender, weak spines. [Pl. 12, fig. 1]

Theobaldia spathipalpis Rond. *Genitalia, male.* Basal clasp segment stout, tapering rapidly to a rather broadly rounded apex. Terminal clasp segment rather slender, slightly expanded at the apex and bearing two short, stout, chitinous spines. Claspette represented by a somewhat conspicuous basal lobe bearing a number of stout, apical setae. Harpe an irregular, angular organ with a somewhat enlarged, spined base and a spatulate, smooth apex. Harpagones very stout with the apex expanded, subtriangular, the base of the apical enlargement coarsely granulate, the apex a smooth acute spine. Unci probably nearly approximate, the apex somewhat enlarged and rather coarsely setose. Setaceous lobes indeterminate in the preparation. [Pl. 13, fig. 1]

Culiseta absobrinus Felt. *Genitalia, male.* Basal clasp segment very stout, broad, tapering rapidly to a rounded apex, and with an inner, subapical, tubercular, setaceous patch. Terminal segment enlarged at base, tapering gradually to apex, which bears a stout, short, apical spine. Claspette a conspicuous, sub-basal lobe bearing several large and numerous smaller setae. Harpes, though apparently absent, are represented by a very inconspicuous, thin structure closely appressed to the inner face of the basal clasp segment. It is setose like the clasp segment and bears at its apex several prominent setae. Harpagones stout, recurved, with several conspicuous, subapical and two or three apical teeth. Unci broad at base, narrowing posteriorly to oblique, rounded extremities. Setaceous lobes slightly produced, separate, each bearing 6 to 10 stout setae. Posterior margin of preceding segment heavily chitinized and with two submedian rows of short, stout, evenspines.

Culiseta consobrinus Walk. *Genitalia, male.* Basal clasp segment broad at base tapering rapidly to a rounded apex, and bears subapically a small, tubercular, setose elevation on its inner face. Terminal segment slightly enlarged at its base, where there appears to be a sensory organ rather stout, tapering gradually to a nearly acute point, which appears to be destitute of an apical spine. Claspette a conspicuous, setose, basal lobe bearing at its apex two very stout spines. Harpes probably much as in C. absobrinus; harpagones strongly curved and with a subapical and stout, recurved apical tooth. Inner face with a number of conspicuous, apparently sensory hairs. Unci slender, separate, with one large tooth near the middle, tapering gradually to a prominent subapical spine and ending in a recurved spur. On either side of the unci and just anterior to the setaceous lobes of the eighth segment there are a pair of peculiar organs, which appear like anastamosing bands of chitin. Setaceous lobes separated, moderately developed and thickly crowned with numerous irregular spines. There is no indication of a row of stout spines along the posterior border of the preceding segment, as in C. absobrinus Felt.

Culex diversus Theo. *Genitalia, male.* Basal clasp segment stout, broadly rounded and ending in a subconical internal lobe. Terminal clasp segment subapical, swollen near the base and along the middle, strongly curved and slender along the apical fourth and

with a long, stout, crooked terminal spine. Claspette possibly represented by a patch of long, thick setae near the middle of the basal segment. Harpes stout, short, the broadly rounded apex crowned with a number of stout, curved, chitinous spines. Harpagones rather slender, slightly curved and with a stout, acute, recurved apical spine. Unci approximate, slender, tapering slightly to the nearly truncate, serrate posterior edge. Both the harpes and harpagones are unusually small compared with the clasp segments. Setaceous lobes indeterminate.

This species, judging from the general characters presented by the wing, should be closely allied to Theobaldia or Culiseta.

CULEX

This genus as now restricted to the Pipiens group, is fairly homogeneous, the various members showing marked similarities in both adult and larval characteristics. Some of the species approach each other so closely as to make it exceedingly difficult to separate them satisfactorily in both adult and larval forms, though differences in one stage or the other or considerable divergence in habits is ample evidence of the validity of the various species. The male Culex is characterized by the rather slender, sparsely plumed palpi usually with the terminal and a portion of the fourth segment extending beyond the tip of the proboscis. The wings exhibit a rather generalized type in the very long fork cells and relatively short petioles thereof. The male genitalia are rather complex in type, rendering it very difficult to satisfactorily homologize the various parts. The claspette is very characteristic in most forms, having a well marked spatulate organ in association with a subapical group of more or less varied, slender, chitinous spines. It may eventually prove best to limit the genus strictly to those forms having a well developed spatulate organ, but in the absence of more striking differences, it seems advisable for the present to include in this group all forms having the characteristic subapical group of spines so well developed in Pipiens. The harpes diverge widely from those of other Culicinae, in that the chitinous, falcate blade is basal or nearly so, whereas in most of the other forms it is apical. The harpagones show a marked tendency to division, giving the appearance of additional organs. The female genitalia usually consist of a simple pair of more or less orbicular lobes.

The larvae are all long tubed forms and resemble each other very closely, though in most species excellent characters for their separation may be found in the varying proportions of the air tube. The pecten at its base is valuable in recognizing species. There are also useful variations in the antennae, particularly in the position

of the tuft. The comb is very similar in the different species and is of comparatively little service in separating the larvae.

Culex pipiens Linn. *Genitalia, male.* Basal clasp segment stout broadly rounded to an oblique apex. Terminal clasp segment large at its base, strongly curved and tapering to a blunt point bearing a stout apical spine. Claspette a subapical group of three stout spines, a smaller group of several stout spines and a well developed spatulate organ. Harpes divided, the major limb stout with a large apical group of stout, strong spines, the minor limb weak, about one fourth the length of the major, falcate with a blunt apex. Harpagones long, slender, strongly curved near the apical third. Unci approximate, slender with posterior extremity broadly excavated, one lobe broadly rounded, the other acute. Setaceous lobes moderately well developed, each with about 16 long, moderately stout setae.

Culex fatigans Wied. *Genitalia, male.* Basal clasp segment stout, broadly rounded to an obliquely truncate apex. Terminal clasp segment stout, strongly curved and tapering to a rather blunt apex bearing a rather stout apical spine. Claspette a subapical group composed of two large and a smaller spine and another group with one large and two smaller spines arising at the base of the spatulate organ. Harpes short, stout, crowned with a thick group of stout, chitinous spines. Harpagones stout, strongly curved near the apical third and with an acute tip. Unci slender, approximate, with a rounded apex. Setaceous lobes poorly developed, each with about six slender, long setae.

The harpes and harpagones are both probably divided as in other closely related forms, but the preparation from which the description was drawn is such that these points can not be demonstrated.

Culex restuans Theo. *Genitalia, male.* Basal clasp segment stout, slightly curved, apex rounded. Terminal clasp segment rather slender, strongly curved, with a fine obtuse point bearing a small apical spine. Claspette subapical, consisting of three stout, closely set, chitinous processes slightly curved apically, a fourth one with a slender recurved point and a characteristic spatulate organ at the base of which are several stout setae. Harpes rather stout, and crowned apically with a series of thickly set, dark brown, stout, chitinous spines and at its base there is a rather conspicuous curved, chitinous process about one half its length. Harpagones bifurcate, the dorsal limb curving mesally to a blunt point. The ventral limb stout, curving dorsally to an acute tip. Unci broad, convolute, tapering posteriorly to an oblique point. Setaceous lobes median, nearly approximate, broadly rounded, bearing a few rather slender setae.

Culex territans Walk. *Genitalia, male.* Basal clasp segment stout, curved, obliquely truncate. Terminal clasp segment rather slender, tapering, with a rather long, slender, articulate terminal spine. Claspette subapical, consisting of a pair of stout, slightly curved, chitinous processes, each with an apical filament and a

closely set distal group of about three shorter, stout setae. Harpes long, rather slender, curved apically and adorned with a series of long, fingerlike teeth. Harpagones fused to form a somewhat keel-like organ with the lateral portion prolonged distally, broadly rounded and tipped with a series of short, stout spines. Unci approximate, slender, excavated posteriorly, with acute dorsal and ventral prolongations. Setaceous lobes small, abruptly rounded, bearing a number of rather fine setae.

Culex tarsalis Coq. *Genitalia, male.* Basal segment of clasp stout, curved, nearly obliquely truncate at apex. Claspette subapical, composed of three stout, closely set, tapering spines with recurved tips and a well defined, spatulate organ, the latter with two curved bristles arising from near its base. Apical segment rather stout, curved, tapering, with a small terminal articulate spine. A rather inconspicuous lobed process bearing short, stout, chitinous teeth, appears to be the basal portion of this organ. Harpes stout, broad, bearing apically a thick mass of stout, nearly black, chitinous spines. Basal portion with a strongly curved, tapering process. Harpagones short, stout, with a prominent ventral, somewhat folded lobe, its apex rounding to a somewhat acute tip, the main portion bearing at its apex two long, stout, dark brown, chitinous teeth and a shorter, intermediate spur. Unci approximate, slender, tapering to acute points. Setaceous lobes slightly developed, rounded, bearing a series of rather long, curved setae.

Culex cylindricus Theo. *Genitalia male.* Basal clasp segment rather stout, rounding gradually to a rather acute apex. Terminal clasp segment stout, tapering gradually to a blunt point bearing a pair of rather stout apical spines. Claspette represented by a subapical group composed of two stout spines with recurved points, a slightly longer, more slender one with a smaller group of three smaller, slender spines with recurved points and a well developed spatulate organ. Harpes stout with a thick, tranverse apical group of stout, chitinous spines, the inner blunt, the outer acute. Harpagones stout, recurved, acute. Unci and setaceous lobes indeterminate in the preparation.

Culex annulirostris Skuse. *Genitalia, male.* Basal clasp segment stout, gently rounded to a rather acute apex. Terminal clasp segment much enlarged at base, tapering rapidly near the middle to a rather acute tip bearing a pair of stout apical spines. Claspette a subapical group composed of three large and three smaller spines and an acute tipped spatulate organ. Harpes divided, the main limb stout with its apex crowned with a thick group of stout spines. Minor limb smaller, strongly curved, falcate with an acute apex. Harpagones slender, divided into a series of about four more or less curved, acute, stout, chitinous processes. Unci slender, approximate, prolonged in a bifurcate Y-shaped apex, the outer limb stout, acute, the inner linear. Unci indeterminate in the preparation.

Culex annulioris Theo. *Genitalia, male.* Basal clasp segment moderately stout, rounding gradually to a somewhat acute apex. Terminal clasp segment enlarged at base, strongly curved at apical third and bearing a short, stout terminal spine. Claspette a subapical group consisting of two very stout, chitinous spines with strongly curved acute tips, a more slender one close beside them, and slightly removed another small group of about six spines and a spatulate organ, the tip of the latter appearing unusually acute. Harpes nearly divided, the main branch stout, strongly curved and with a thick apical tuft of stout, chitinous spines. Minor limb strongly curved, sickle-shaped and with an acute apex. Harpagones short, stout, terminating in a series of strongly curved, stout, chitinous spines. Unci slender, probably approximate, gradually rounding to an acute apex. Setaceous lobes weakly developed, each with about six slender, curved setae.

FIG. 13 Culex annulioris, harpe, much enlarged, showing the smooth, basal, arcuate, chitinous process (Original)

Culex tigripes Grand. *Genitalia, male.* Basal clasp segment rather expanded at the extreme base, moderate, tapering gradually to a narrowly rounded apex. Terminal clasp segment stout, tapering and curving strongly to a slender apex bearing a short, stout apical spine. Claspette a conspicuous subapical process bearing three stout, chitinous processes and three smaller ones but with no trace of a spatulate organ. Harpes divided, the major limb rather stout with a broadly expanded apex crowned with a thick group of stout, chitinous spines. Minor limb about one fourth the length of the major, strongly curved and with a blunt apex. Harpagones broadly expanded at the base, terminating in a long, slender, blunt, chitinous spine and with a group of short, stout, chitinous spines near the base of the long one. Unci slender, probably approximate, tapering gradually to a broadly rounded apex. Setaceous lobes weakly developed and with about eight long, slender setae.

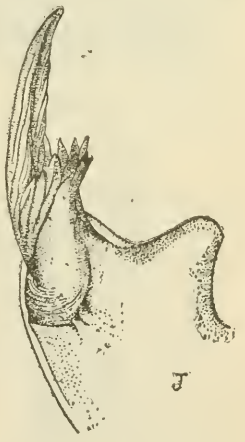


FIG. 14 Culex tigripes, harpago, illustrating the peculiar basal, chitinous processes, much enlarged (Original)

Culex concolor Rob.-Desv. *Genitalia, male.* Basal clasp segment stout, subconical with a broadly rounded apex. Terminal clasp segment rather stout, somewhat enlarged basally and with a rather long, stout apical spine. Claspette a subapical conical internal process bearing four simple, stout, chitinous spines and so far as can be determined with no trace of a spatulate organ. Harpes divided, the main limb long, slender, crowned with a thick group of stout, chitinous spines. Minor limb rather short, stout and at

nearly right angles. Harpagones enlarged at base, strongly angulate near the middle and with one very large, stout, chitinous spine and numerous minor ones. These latter appear much like long, fused, chitinous processes. Unci slender, tapering to a broadly rounded apex. Setaceous lobes indeterminate in the preparation.

FIG. 15 Culex concolor, a portion of the harpes and harpago with the peculiar basal, chitinous processes, much enlarged (Original)

This species is closely allied to C. tigripes Grand., both presenting a most interesting stage, showing the partial division of the harpagones. In these two species the main chitinous spur is well marked and the numerous smaller ones at its base are so well divided that it is easy to see the connection between these and the same spurs more strongly developed in such species as C. annulirostris Skuse.

Culex viridiventer Giles. *Genitalia, male.* Basal clasp segment very stout, broad, with a broadly rounded apex. Terminal clasp segment rather long, tapering gradually in a double S-shaped curve to an acute apex. This segment is remarkable because of the series of irregular, coarse setae along the middle of the ventral margin. Harpes stout, terminated by a dense series of coarse, chitinous spines, the outer ones blunt, the inner acute. Harpagones rather slender, tapering to an acute tip. Unci approximate, tapering rapidly to an acute tip and remarkable because of the series of stout, chitinous teeth along the middle of the ventral margin and the pair of stout teeth side by side near the base. Setaceous lobes weakly developed and bearing a series of fine, long, curved setae. [Pl. 14, fig. 1]

FIG. 16 Culex viridiventer, terminal clasp segment, much enlarged (Original)

This species presents remarkable features in the serrations of the terminal clasp segment and the very pronounced ones on the unci, reminding one somewhat of similar structures occurring in Megarhinus. It might well be referred to a new genus and we refrain from erecting one because of our unfamiliarity with the Indian fauna.

Culex pulcriventer Giles. *Genitalia, male.* Basal clasp segment enormously dilated, oval and with a peculiar internal patch of long, halbertlike scales. Terminal clasp segment with the basal portion somewhat enlarged, slender and with a stout, curved apical spine. Harpes very broadly dilated, excavated and somewhat spoon-shaped. Harpagones stout, curved, with an acute, recurved apex. Unci slender, rounding gradually to a rather acute apex. The setaceous lobes appear to be represented by a pair of large, inflated organs densely clothed exteriorly with numerous long, fine setae. [Pl. 14, fig. 2]

FIG. 17 Culex viridiventer, unci, showing the unique series of teeth, much enlarged (Original)

This species diverges widely from the normal type of Culex or other allied American genera and it might well be referred to a new genus. We refrain from erecting one because of our unfamiliarity with the Indian fauna.

Melaniconion atrata Theo. *Genitalia, male.* Basal clasp segment stout, tapering rapidly to a rather broad apex. Terminal clasp segment rather stout, basal portion greatly enlarged, apical portion slender and bearing a stout, subapical spine. Claspette represented by a conspicuous subtriangular apical lobe and an inner prominence bearing two stout, chitinous spines, the larger on a well defined stalk. Harpes rather distant, stout, terminating in a series of six or seven stout, chitinous spines. Harpagones rather stout, ending in an acute point. Unci slender, approximate with a broadly rounded apex. Setaceous lobes indeterminate. [Pl. 15, fig. 1]

TAENIORHYNCHUS

The study of male genitalia of the species at hand is not without interest, particularly as the forms we have been able to secure, appear to have considerable in common. One of the most striking generic characteristics of this group, is the enormous straight, thickened, chitinous process terminating the claspette. Harpes apparently absent. Harpagones with prominent apical teeth varying in number from three to about five. The numerous fine teeth along some portions of the margin of the unci, are another feature apparently peculiar to this remarkable group of insects. The setaceous lobes are fairly well developed and the seventh segment bears submedian groups of stout chitinous spines.

This genus presents some interesting diversities in the structure of the male genitalia. The terminal clasp segments are normally stout, curved, simple, but in the African species, Taeniorhynchus aurites Theo., these organs are remarkable because of the enormous, rounded, bladelike posterior lobe and the unique compound hairs on its posterior border [pl. 16, fig. 2.] The

Asian Taeniorhynchus brevicellulus Theo. [pl. 16, fig. 1] is a remarkable specialized member of this genus judging from the exceedingly grotesque harpagones, still its other features agree in the main with those stated above, and we see no reason why it should be given a different position than that assigned by its describer.

The genus Taeniorhynchus is evidently closely related to Theobaldia and Culiseta, and it may be regarded as a more specialized form of this group. The slender spines of the claspette in Theobaldia, have become thickened and fused in Taeniorhynchus, and the denticulations of the harpes in the first named genus are much more pronounced and segregated in this. The presence of submedian groups of stout, chitinous spines on the eighth segment, also indicates a close affinity with the above named genus. This is borne out by an examination of wing characters. The large, somewhat broad scales of Theobaldia and Culiseta are represented in Taeniorhynchus by much dilated ones and there is also a marked similarity in venation.

Taeniorhynchus perturbans Walk. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a broadly rounded apex. Terminal segment greatly swollen at the middle and also at the apical third, at which latter it tapers gradually to a small, stout, terminal spine. Claspette a conspicuous lobe bearing a very thick, straight spine and another smaller, tapering one. Harpagones stout, slightly excurved and strongly recurved, ventral margin fringed with a series of thin teeth, which are most highly developed at the distal extremity. Unci curved, nearly approximate, tapering gradually to a rather obtuse, serrate extremity. Dorsal margin remarkable because of the series of fine teeth along the anterior two thirds. Setaceous lobes moderate, bearing three to five stout spines. Seventh segment with a pair of submedian groups of three to six stout spines. [Pl. 15, fig. 2]

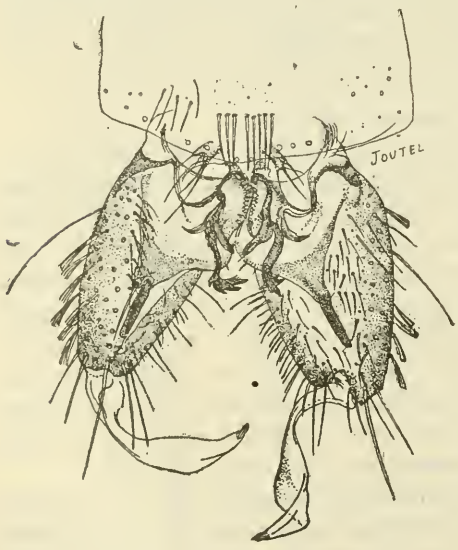


FIG. 18 Taeniorhynchus perturbans, ventral aspect of male genitalia, greatly enlarged (Original)

Female. Lobes composed of two segments, basal minute, terminal broadly dilated, obliquely truncate. Tergum broadly rounded, ventral plate rounding posteriorly to a median incision.

Taeniorhynchus brevicellulus Theo. *Genitalia, male.* Basal clasp segment very stout, broadly rounded to a blunt apex. Terminal clasp segment enlarged at the base and extremity, strongly curved and bearing a short, stout apical spine. Claspette a conspicuous basal lobe bearing a stout, chitinous spine. Harpagones very stout, enlarged posteriorly and unique because of the two or three stout, recurved, chitinous processes, giving the organ an appearance not unlike that of a bird's beak. Unci approximate, broadly rounded exteriorly, tapering gradually to blunt, approximate apexes, each crowned ventrally with a series of fine, stout, chitinous teeth. Setaceous lobes approximate, well developed, each with four or five stout apical spines. [Pl. 16, fig. 1]

Taeniorhynchus aurites Theo. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a broadly rounded apex. Terminal clasp segment stout, strongly bent at the basal third, also at the apical fourth and with a stout, short, terminal spine. This segment is remarkable because of the very large spatulate appendage near its middle with a conspicuous group of compound branching hairs arising from near its base. The spatulate appendage and the extremity of the segments is also rather thickly clothed with stout, somewhat curved hairs. Claspette a conspicuous basal lobe bearing a very thick, stout, terminal spine with a much smaller one beside it. Harpagones stout, strongly curved at the apical fourth and bearing several large teeth along its rounded extremity and terminated by a pair of very stout, chitinous, recurved teeth. Unci somewhat curved, nearly approximate, expanded at the apical fourth and thence gently rounded to acute, recurved, approximate points. Ventral surface with the apical portion armed with a series of irregular, stout teeth. Setaceous lobes with the eighth segment produced and marked only by a series of stout, transverse spines along the posterior margin of the segment. [Pl. 16, fig. 2]

Stegomyia fasciata Fabr. *Genitalia, male.* Basal clasp segment very broad, subtriangular, broadly rounded internally, gently so externally. Terminal clasp segment rather stout, slightly swollen at distal third, tip abruptly narrowed and bearing a rather stout terminal spine. Claspette a conspicuous internal subapical setaceous lobe bearing several stout angulate chitinous spines and a great many stout setae. Harpes apparently wanting. Basal lobe of harpagones stout, apical portion subtriangular, the latter irregular, consisting of a long, slightly recurved main limb and a smaller, thick inner one. Unci slightly convolute, terminating in a rounded dentate apex. [Pl. 17, fig. 1]

Stegomyia scutellaris Walk. *Genitalia, male.* Basal clasp segment stout, gradually tapering to a broadly rounded apex. Terminal segment rather long, slender, slightly expanded at the base, more so at the tip and with a very short, stout subapical spine. Claspette apparently represented by a thin basal lobe densely

setose along its margin. Harpes divided, the main limb stout, crowned apically with a dense group of very stout, chitinous spines. The minor limb nearly as long, slender, somewhat falcate, apex acute. Harpagones stout, longer than harpes, terminating in a rather blunt, chitinous spur. Unci indeterminate.

Stegomyia notoscripta Skuse. *Genitalia, male.* Basal clasp segment stout, conical, tapering gradually to a rounded apex. Apical segment rather stout, very short and bearing a long, slender terminal spine. Claspette apparently wanting. Harpes, basal portion naked except at the extreme base; apical part curved, falcate, tapering to an acute point. Harpagones stout, terminating in a stout, recurved spine. Unci slender, approximate, with a broadly rounded apex. Setaceous lobes moderate, each with three or four stout, chitinous spines.

The genitalia in this species are peculiar in that the basal clasp segments are thickly clothed with stout, broad scales. Stegomyia fasciata is evidently the type of this genus, and as its genitalia diverge remarkably from the above described form, the latter should be referred to a new genus. It is much closer related to Culicada than to Stegomyia and might well be referred to that genus.

Pneumaculex signifer Coq. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a narrowly rounded apex. Terminal segment rather stout, slightly curved, somewhat expanded at the base and with a long, rather stout apical spine, the latter with a stout apical tooth and four or five more slender, ventral teeth. Claspette a rather conspicuous basal lobe bearing several stout, chitinous spines. There are also two stout, chitinous spines arising direct from the venter of the basal clasp segment near the apex of the claspette. Harpes moderate, somewhat inflated near the middle and tapering to three stout, chitinous spines. Harpagones divided, composed of two stout, recurved, chitinous processes, the posterior limb larger than the anterior. Unci approximate, fused, swollen at the base, slightly contracted posteriorly and with three rather small subapical chitinous spines, posterior margin broadly rounded. Setaceous lobes apparently absent. [Pl. 17, fig. 2]

Protoculex serratus Theo. *Genitalia, male.* Basal clasp segment rather stout, slightly curved, narrowly truncate apically. Terminal clasp segment rather slender, slightly swollen near the middle and abruptly curved near the tip and with a long, slender apical spine. Claspette a distinct, nearly free basal bladelike process bearing on its outer edge near the middle a stout, irregularly curved, acute chitinous spine. At the apex of the basal clasp segment there is a long, subacute, bladelike process. Basal portion of harpes enlarged, somewhat triangular, apical portion smooth, irregularly curved, with a rounded apex. Harpagones stout, strongly curved, with an acute, recurved apical spine. Unci approximate, outer margin curved, tapering to an acute point. Setaceous lobes moderate, each slightly divided and bearing about four long, stout, chitinous spines. [Fig. 4 and pl. 18, fig. 1]

AEDEOMYINAE

We have allowed several very divergent forms to remain under this subfamily head for the time being, largely because of insufficient material in this exceedingly interesting group. Deinocerites cancer Theo. possesses many features in common with Culex proper, and diverges widely from the abnormal Aedes fuscus O. S. associated therewith. There is little in common between the latter and Uranotaenia. The unique Wyeomyia smithii Coq. is an even more divergent type presenting more generalized features.

DEINOCERITES

This genus is an abberrant, synthetic Culicid, unique not only on account of antennal characters but also in the genitalic structures of both male and female. The antennae of the female are remarkable in having the second segment greatly prolonged, equal in length to the three following and clothed with scales. The male antennae are greatly produced, the second to the seventh segment being prolonged, the second about the length of the two following and the others gradually decreasing in length to the eighth. The second, third and the basal portion of the fourth segment are sparsely clothed with scales. This entire organ in the male is longer than the body. It is not plumose as in most Culicids, though the hairs covering segments 2 to 7, like those on segment 2 of the female, are a little longer and there is little evidence of the sparse basal whorl of longer setae so characteristic of most Culicids and evident in this species on the other antennal segments [Fig. 1]. The palpi are composed of four segments in each sex, with the fifth probably represented by a minute apical prolongation. The fourth segment in the male is about one half longer than the third and somewhat larger in the female. These two segments are nearly equal in length though the fourth is somewhat more dilated.

Deinocerites cancer Theo. *Genitalia, male.* Basal clasp segment stout, broadly rounded apically. Terminal clasp segment stout, slightly curved, excavated internally, somewhat enlarged apically, externally clothed with numerous short hairs and bearing in an apical notch a pair of curved, clawlike spines. Claspette represented by a subapical internal lobe bearing two stout, chitinous, curved, fingerlike processes, a large chitinous spine and several smaller ones. Harpes short, broad, stout, basal processes crowned with a series of close-set, blunt, chitinous teeth and bearing a number of rather stout, subapical setae. Minor limb nearly independent, a very long, stout, chitinous process about two thirds the length of the basal clasp segment, with the basal portion somewhat enlarged. Harpagones with a long, curved, blunt apical spine, the basal portion broadly expanded, somewhat convolute, with its rounded margin crowned with a series of stout, slightly

curved, chitinous spines and its ventral margin terminated by a stout, recurved hook. Unci long, slender, approximate, broadly rounded posteriorly. Setaceous lobes probably absent.

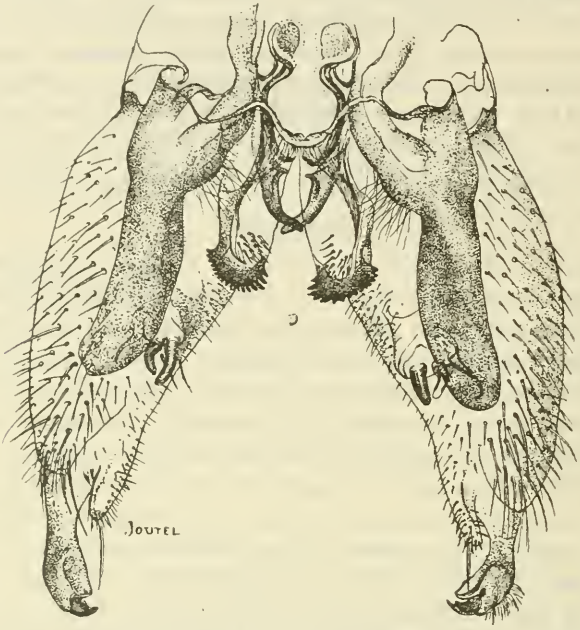


FIG. 19 Deinocerites cancer, ventral aspect of male genitalia, much enlarged (Original)

Female. The female genitalia of this species diverge very widely from the ordinary type. There are a dorsal pair of subtriangular, articulated processes, each bearing two long nonarticulated, stout, curved, blunt, chitinous processes. Tergum small, deeply excavated mesally. Venter of eighth segment produced as a pair of stout, chitinous, nonarticulate lobes, the ventral posterior margin crowned with a series of stout, chitinous spines arising from conspicuous tubercules.

Aedes fuscus O.S. *Genitalia, male.* Basal clasp segment stout, subconical. Terminal segment subapical with a very large, rounded basal lobe and the slender tip with a pair of blunt, divergent processes. There are no traces of a terminal articulated spine. Claspette a conspicuous subtriangular, ventral prolongation of the inner basal wall. Harpes very slender, semitransparent at base, more strongly chitinized and brownish apically, bifurcate. Lateral limb about one third longer than the median branch, each rather thickly clothed with fine setae and ornamented with several lateral and a long conspicuous terminal spine. Harpagones stout, recurved, tapering to a rather acute, obscurely dentate point. Unci narrow, approximate, ventral limb slightly excurved to a nearly acute point, dorsal limb stouter, incurved to an acute point. Setaceous lobes stout, rounded apically and with numerous long, rather weak spines. These latter organs are more or less concealed by the overlying appendages of the preceding segment. [Pl. 18, fig. 2]

Female. Lobes about four times as long as broad, somewhat contracted at the base and tapering rapidly from the basal third to the rather acute, almost unarmed tips. Ventral plate not as wide as a lobe and extending to the posterior half, strongly emarginate apically. Posterior margin of eighth segment armed with a series of long, stout spines.

Uranotaenia sapphirina O. S. *Genitalia, male.* Basal clasp segment stout, subconical. Terminal clasp segment stout, nearly straight and tapering rapidly near the tip to a nonarticulate spine. Interior face of apical portion denticulate and with a small spine. Claspette probably represented by a slight setaceous process near the middle of the basal segment. Harpes slender, slightly constricted at the apical fourth and with a dark brown, slightly curved and enlarged apex. Harpagones stout, constricted just beyond the middle and ending in a pair of divergent blunt processes. Unci stout, approximate with a number of diverging apical chitinous processes.

Uranotaenia socialis Theo. *Genitalia, male.* Basal clasp segment very broad with the apex broadly rounded. Terminal clasp segment stout, nearly straight and tapering rapidly near the tip to a moderate, acute apical spine. Claspette probably represented by a slight setaceous process near the middle of the basal segment. Harpes stout, broad, apparently with three stout subapical teeth on each side, apex blunt. Harpagones stout, tapering and bearing one stout subapical and two apical curved, chitinous processes. Unci slender, approximate, broadly rounded posteriorly.

The parts are so minute and the material so scanty that it was impossible to make a preparation showing all the details in a satisfactory manner and it may be necessary to revise the above with more material at hand.

Wyeomyia smithii Coq. *Genitalia, male.* Basal clasp segment rather stout, curving gradually to a broadly rounded apex, and with a small basal, setaceous lobe, the claspette. This segment is unique since its distal portion is composed of two equal lobes very slightly connected posteriorly. Terminal segment remarkable, composed of an irregular main limb terminated by several conspicuous teeth and ornamented along its inner margin with a series of rather stout spines. Near the middle arises a fingerlike process thickly armed with a brush composed of oblique fine retrose spines. On the opposite side of the central limb there is a large falcate process, the inner surface armed with several stout spines. This arm is connected with the central limb by a broad sheet of probably chitinous tissue forming a sort of pocket. Harpagones, much smaller than the harpes, both consisting of a broad basal platelike structure rounding abruptly to a short, stout, bladelike segment armed with a conspicuous spine, and with its apex obliquely truncate. Unci broad, platelike, fused mesally to form a keel-like structure. Setaceous lobes rather small, each bearing four or five long, stout setae.

Female. Lobes broadly rounded, apparently attached dorsally, the nearly circular ventral margin free. Tergum broadly rounded

at apex, strongly expanded at the base and extending beyond the lobes.

Megarhinus portoricensis Von Roder. *Genitalia, male.* Basal clasp segment stout, subtriangular, tapering to a narrowly rounded apex. Terminal segment rather slender, base slightly enlarged, tip slender, bearing a rather long, acute terminal spine. Claspette represented by a simple, broadly rounded basal setaceous lobe. Harpes long, excavated externally and terminated by a stout, chitinous spine and a series of minute denticulations. Harpagones slender, closely appressed, ventral edge with a series of minute teeth. Unci fused, slender, ending in acute points. Setaceous lobes moderately well developed, thin, bearing numerous long, rather slender setaceous spines. Seventh segment with a transverse row of very long slender spines across the posterior third, evidently a generalized type of the submedian groups of spines observed in some other genera. [Pl. 19, fig. 1]

CORETHRINAE

The Corethrinae are a fairly homogeneous subfamily, despite the wide differences in larval structures, though there is a substantial agreement in habits, all being aquatic and predaceous. Corethrella appears to be the more generalized of the various genera, there being comparatively slight differences between the antennae in the two sexes [fig. 2]. Those of the female are remarkable because of the rudimentary whorl of hairs near the middle of each segment, and those of the male are unique on account of the long, fine hairs continued to the apical fourth. The wings of both sexes are substantially alike, both possessing the oblique scales along the margin, a character almost universally limited to the female. The claws are simple in both sexes, though those of the fore and mid-legs of the male are

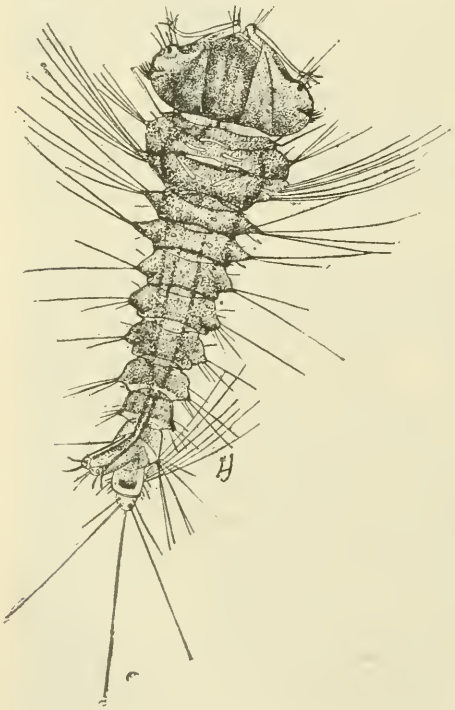


FIG. 20 Corethrella brakeleyi, dorsal view of larva showing the peculiar head structures and the paired separate spiracles of the air tube, much enlarged (Original)

larger. Eucorethra is somewhat more highly specialized, the antennae being markedly different in the two sexes and with oblique scales present along the posterior margin of the female wing and absent in that of the male. The species of Corethra exhibit well marked sexual differences and may be instantly recognized by the unique, very short first tarsal segment. The Sayomyias present a somewhat general resemblance to the Corethras, though they are easily distinguished on account of the first tarsal segment being longer than the others. The male genitalia of these genera agree substantially in possessing relatively simple clasp segments and with a single pair of subsidiary organs, probably the harpes.

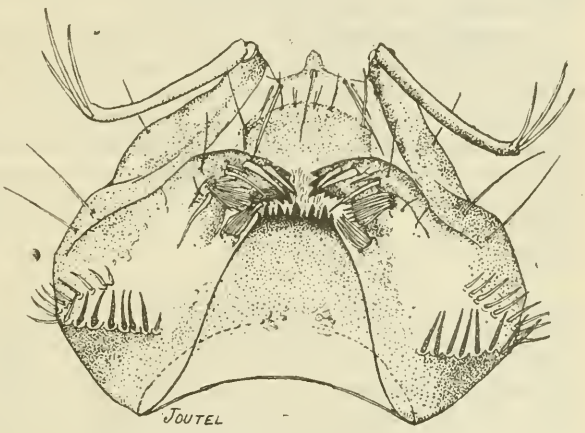


FIG. 21 Corethrella brakeleyi, ventral aspect of larval head, much enlarged (Original)

The larvae of this group present marked structural differences. That of Corethrella is exceedingly peculiar and may be considered a divergent synthetic form. The head is armed laterally with oblique rows of stout spines not seen in any other culicid larva, and the rather broad, stout air tube is peculiar because its tracheae are simple and open in well separated spiracles at the extremity of the tube. The larva of Eucorethra likewise has independent tracheae and on account of its surface-feeding habit possesses a short air tube and in a general way resembles a giant Anopheles larva, though with no trace of the characteristic comb of the latter. Corethra larvae are interesting because they possess a rudimentary air tube with well marked tracheal dilations or air reservoirs in the enlarged thoracic and eighth abdominal segments. The Sayomyia larvae are most peculiar. They have no vestige of an air tube and are remarkable because of their extreme transparency, the only color being the dark mouth parts, the black eyes and pigmented air sacks in the thoracic and eighth abdominal segments. The larval mouth parts of this genus are very different from those of the other genera associated therewith.

Eucorethra underwoodi Undw. *Genitalia, male.* Basal clasp segment very stout, broad, apex obliquely rounded. Terminal segment stout, somewhat curved with a number of stout setae on its basal portion, apical part slightly enlarged and bearing a short, stout, articulate spine. Harpagones probably represented by short, stout, distant, quadrangular processes. Unci long, slender, largely retracted, apical portion irregularly convolute, quill-like, terminated in a somewhat acute tip.

Corethrella brakeleyi Coq. *Genitalia, male.* Basal clasp segment stout, slightly concave interiorly, broadly rounded exteriorly to a somewhat narrow apex bearing long, strongly arcuate terminal segments, the latter ending in an acute point but with no indication of a terminal spine. Claspette apparently represented by a stout, chitinous spine at the basal third of the large clasp segment. Harpes approximate, long, slender, tapering gradually to a fine, rounded apex. Harpagones, unci and setaceous lobes apparently absent. [Pl. 19, fig. 2]

Female. Lobes composed of a smaller anterior segment and a larger broadly rounded posterior one. Tergum broadly rounded posteriorly, ventral plate tapering obliquely to a narrow truncate margin and with a stout seta at the posterior angles.

Corethra cinctipes Coq. *Genitalia, male.* Basal clasp segment stout, rounded exteriorly, anterior margin nearly straight, obliquely truncate. Terminal segment rather stout, somewhat curved and slightly enlarged apically; tip with a small, acute, articulate spine. Harpes absent. Harpagones approximate, stout, with a slight ventral and dorsal curve, terminating in a stout, decurved, bluntly rounded point.

Corethra lintneri Felt. *Genitalia, male.* Basal clasp segment gently rounded exteriorly, with interior margin nearly straight, apical portion obliquely rounded. Terminal segment rather stout, somewhat curved and slightly enlarged apically, tip bearing a small articulate spine. Harpes absent. Harpagones stout, somewhat irregular, terminating in an acute, slightly recurved, chitinous spine.

Female. Base of lobes sublateral, widely separated, expanding posteriorly to an obliquely truncate apex.

Corethra karnerensis Felt. *Genitalia, male.* Basal clasp segment gently rounded exteriorly; interior margin slightly curved, apex rather broadly rounded. Terminal segment rather stout, slightly enlarged at both extremities and with a moderate, acute apical spine. Harpes absent. Harpagones stout, somewhat irregular, terminating in an acute, slightly recurved, chitinous spine.

Female. Lobes almost approximate, very broad, scarcely longer than wide and with numerous long, coarse setae.

Corethra fuliginosus n. sp. *Genitalia, male.* Basal clasp segment stout, slender with a broadly rounded apex. Terminal clasp segment very long, slightly expanded at the base, more so distally and with a rather stout, acute apical spine. Harpes apparently absent. Harpagones short, stout, slightly recurved, broadly rounded apically. Tergum obliquely truncate posteriorly.

Sayomyia trivittata Loew. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a rather broadly rounded apex. Terminal clasp segment long, slightly expanded at the base, tapering to a blunt, simple apex. Claspette and harpes apparently absent. Harpagones stout, irregularly swollen near the middle and terminating in a stout, rather obtuse, recurved tip.

Sayomyia hudsoni Felt. *Genitalia, male.* Basal clasp segment stout, rather short, broadly and slightly rounded apically. Terminal segment stout, slightly curved, tapering gradually to a rounded apex with no terminal spine. Claspette and harpes apparently absent. Harpagones with basal portion rather slender, apical half enormously dilated, the posterior margin broadly rounded, anterior margin extending at its lateral extremity into a prominent beak, giving the apical portion of the organ an appearance not unlike a bird's head with the beak pointing anteriorly. Ventral surface ornamented with a series of stout, chitinous spines. Unci indeterminate. Setaceous lobes widely separated, thin, prolonged posteriorly and bearing several stout setae.

Sayomyia albipes Johans. *Genitalia, male.* Basal clasp segment rather slender, long, with broadly rounded apex. Terminal segment slightly curved, tapering gradually to a rather broadly rounded apex. Claspette and harpes absent. Harpagones, basal portion broad, oblique, apical furcate, enlarged, the longer limb strongly curved, the shorter apparently an excavated spur.

Sayomyia rotundifolia Felt. *Genitalia, male.* Basal clasp segment rather stout, long, broadly rounded at apex. Terminal clasp segment rather stout, slightly curved, tapering to a bluntly rounded tip with no apical spine. Claspette and harpes apparently wanting. Harpagones stout, apical half furcate, consisting of two strongly recurved limbs, the larger with a prominent, slightly curved spine near its middle.

JASSIDAE OF NEW YORK STATE

BY HERBERT OSBORN

A comprehensive list of the Jassidae of New York State seems specially warranted because so large a number of species occurring in the United States have been described from that State, owing to the work of Dr Fitch and Mr Van Duzee and, moreover, the fact that its fauna is fairly representative for the eastern United States. The present report is based on previous lists or descriptions by Fitch, Van Duzee, Felt, Southwick, Slingerland and others; the material submitted to the writer by these parties or examined in the collections at Cornell University and the New York State Museum and personal collections in the summer of 1904, when the writer had the opportunity to visit different parts of New York State, examining collections and collecting new material in the vicinity of Buffalo, Ithaca, Albany, Salem, Long Island and Staten Island. Representative sections of the State were thus covered and with the material previously accumulated or reported, covers, it is believed, quite thoroughly the Jassid fauna of the State. Furthermore, collections by Mr E. P. Van Duzee in the Adirondack region extends the area covered still more thoroughly.

The economic importance of the Jassidae was recognized by Dr Fitch in his various writings and he described a large number of the species as injurious to forest trees, grasses, etc. The importance of these insects is not yet fully appreciated owing to the nature of their work but they will undoubtedly become more fully recognized as farmers become aware of the more insidious sources of loss to their various crops. Attention has been called elsewhere to the destructive effect of these insects in pastures and meadows but observations during the past summer in the pastures and lowlands of New York indicated less loss of this sort than has frequently been noted in other localities. This may have been in part due to the season, the constant moisture affording opportunity for the crop to grow continuously. In some cases the hillside pastures were pretty badly infested and the growth of the crop evidently much reduced, also in low ground, marshy pastures, certain species swarmed in such numbers that the vegetation must have been drained to a serious extent.

It may be noted that the mode of feeding in the group consists in puncturing the tissues of various plants, sucking the juices and thus draining their vitality though not necessarily causing the

death of the plant or any considerable portion of it. The drain, however, if the insects are plentiful is constant for pretty much the entire season and there can be no question that a large part of the growth is devoted to the nutrition of these insects.

In the following list we have endeavored to include all the species known to occur in the State with notes on their abundance, food plants, distribution, life history, and habits; in short, the essential facts related to their effect on different crops and furnishing the basis for further detailed study of such species as may seem to demand more thorough investigation.

I am under special obligation to Dr E. P. Felt for the opportunity to study these insects in various parts of the State and get together the material for this paper and for his interest in its publication. Mr Van Duzee has furnished me with numerous records and specimens and given me free access to his collection. Professor Comstock placed the Cornell collections at my disposal. The authorities of the American Museum afforded me free opportunity to examine collections there. Prof. C. B. Davenport placed the facilities of the Cold Spring Harbor laboratory at my disposal and Mr J. R. De la Torre Bueno has furnished me with many specimens from the vicinity of New York.

I was particularly glad to be able to collect at Salem, the locality where Dr Fitch lived and did much of his entomological work. The collections there brought to light include a large proportion of species which he had described and these have been of particular value and interest as a basis of recognition for his species and for comparison of specimens from other localities.

Of the New York species of Jassidae 12 were described by Say all of which are satisfactorily referred. 30 were described by Fitch and 28 definitely placed by types or descriptions. Eight have been described by Uhler, 28 were described by Van Duzee, others by Osborn and Ball, Fallen, Gillette, Linnaeus, Fabricius, Provancher and others. There are very few that may now be considered in question.

All the species in this group known to Dr Fitch comprised 45. Van Duzee's list of Buffalo Hemiptera includes 93 species. The number brought into the present list all of which are based on authentic records or specimens in hand is about 175. Doubtless there are some species to be added—that are known for New Jersey or Maryland, Maine and Canada but I believe it safe to say that the list presents a fairly complete presentation of the Jassidae of the State.

The group Jassidae in its wider sense, or the superfamily Jassoidea of Van Duzee, includes insects distinguished by having antennae setaceous, situated in front of the eyes, the pronotum well developed, scutellum triangular, wings generally opaque but with distinct nervures and the tibiae with a double row of spines on the dorsal side and without a circlet of spines on apex. The group as so defined includes four well marked families distinguished by shape of head and position of antennae.

A synopsis of these families and genera somewhat modified from the scheme proposed by Mr Van Duzee is offered below. The changes suggested are in part due to the description of new genera proposed since Mr Van Duzee's valuable key was published 10 years ago, partly to different value placed on some of the characters used in generic separation which the examination of material in the new species and genera seems to confirm. Thus, I have revised the grouping of genera under Deltocephalini to include Scaphoideus and adapted his Athysanini to the inclusion of several new genera. These changes while not solving all the difficulties apparent in these complicated groups are believed to permit a more natural grouping than is possible under the old system.

Synopsis of families, Jassoidea

A Elytral veins branching on the disk, forming fork inclosing anteapical cells.

a Head very short, vertex sloping or rounding on to the front and ocelli on front. . . . . Bythoscopidae

aa Head more or less prominent, the ocelli located on the disk of the vertex . . . . . Tettigonidae

aaa Head produced or rounded, ocelli on margin between vertex and front . . . . . Jassidae

AA Elytral veins branching at base and passing without fork to the apical cells. Ocelli usually wanting . . . . . Typhlocybidae

Genera represented in New York

Superfamily **Jassoidea**

Family *Bythoscopidae*

Bythoscopus
Idiocerus
Pediopsis
Agallia

Family *Tettigonidae*

Subfamily TETTIGONINAE

Aulacizes
Oncometopia
Tettigonia
Helochara

Diedrocephala
Draeculacephala
Eucanthus
Subfamily GYPONINAE
Xerophloea
Gypona
Penthimia
Family *Jassidae*
Subfamily ACOCEPHALINAE
Strongylocephalus
Acocephalus
Spangbergiella
Parabolocratus
Paramesus
Subfamily JASSINAE
Platymetopius
Deltocephalus
Scaphoideus
Athysanus
Driatura
Athysanella
Goniagnathus
Eutettix
Phlepsius
Thamnotettix
Chlorotettix
Jassus
Paracoelidia
Cicadula
Gnathodus
Family *Typhlocybidae*
Alebra
Dicraneura
Empoasca
Eupteryx
Typhlocyba

Family BYTHOSCOPIDAE

Genus BYTHOSCOPUS Germ.

Bythoscopus variabilis Fitch

♀ Athysanus variabilis Fitch. Homop. N. Y. State Cab. 1851. p. 60; reprinted in Lintner. 9th Rep't. 1893. p. 400; N. Y. State Agric. Soc. Trans. 1858. 18: 853

Bythoscopus variabilis Walk. Homop. 1851. 3: 876; Van Duzee, Am. Ent. 1890. 6: 223; Psyche, 5: 390; reprinted in Lintner. 9th Rep't. 1893. p. 410

♂ Athysanus abietis Fitch. Homop. N. Y. State Cab. 1851. p. 60; reprinted in Lintner. 9th Rep't. 1893. p. 400

Bythoscopus variabilis Van Duzee. Buf. Soc. Nat. Hist. Bul. 4, p. 144

The type[1] specimens are well preserved and leave no question as to the identity of the species. A very full series including representatives of 13 varieties is contained in the Fitch material in the National Museum.

Reported from Buffalo on birch [Van Duzee, Buf. Hemip. p. 144]. Evidently generally distributed.

Bythoscopus sobrius Walk.

Bythoscopus sobrius Walk. Homop. 1851. 3: 874; Fitch, reprinted in Lintner. 9th Rep't. 1893. p. 400; N. Y. State Agric. Soc. Trans. 1858. 18: 853

Bythoscopus sobrius Van Duzee. Buf. Soc. Nat. Hist. Bul. 4, p. 195.

Recorded by Van Duzee for Colden, Lancaster.

[1] There is an interesting question regarding the types of Fitch's species and one which it seems rather difficult to settle. The paper on Homoptera published in the New York State Cabinet Catalogue in 1851 includes the numbers arranged serially according to the species described. These numbers agree with numbered specimens which were deposited in the State Cabinet of Natural History, which specimens have since remained in the custody of the Museum. So far as preserved they are unquestionable examples of these species as indicated by Dr Fitch himself and whether termed "types" or not they must be considered as equivalent to types in their authority. Dr Fitch's private collection which included examples of species that he described was broken up but the Homoptera were finally purchased by the United States National Museum and specimens of Jassidae bearing Fitch's labels which have for Fitch's species been marked with type labels, stand now in the National Museum collection.

They do not, however, bear numbers which correspond with the published catalogue so that it has appeared to me that the published evidence would favor the Albany specimens as the types. Mr Schwarz tells me, however, that Fitch's descriptions were drawn from specimens numbered to correspond with numbers in his notebooks and that these numbers are the most positive basis of recognition of the specimen from which the original description was drawn. Such numbers occur on the Psyllidae and specimens in some other groups but on examination with this point in view it turned out that the Jassids, at least for all species examined, do not contain a Fitch number.

It is to be noted that in certain species, as for instance Idiocerus lachrymalis, the Albany series is complete for not only typical forms but for all of the described varieties, whereas the Washington series includes an example of but one form. On the other hand, for Bythoscopus variabilis the Washington series is by far the most complete including representatives for the described varieties whereas the Albany collection includes but one (?) form, all the varieties having been omitted or subsequently lost. Fortunately so far as observed, there is close agreement between these specimens in the two collections, a fact which would be expected from Dr Fitch's well known care and hence the question of the validity of the type specimen becomes less important.

It appears to me, however, that on the whole it would be best since the Albany species bear definite numbers agreeing with the published descriptions to consider these as types and the other specimens as cotypes. It at least seems the rational course to pursue for such specimens in the National Museum as, while bearing labels written by Dr Fitch, do not possess numbers which would identify them as the particular specimens from which the descriptions were written.

Bythoscopus cognatus Van Duzee

Bythoscopus cognatus Van Duzee. Am. Ent. 1890. 6: 224

Bythoscopus cognatus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 195

Van Duzee's record for this species at Lancaster, 1904 records for Lake Placid and Phoenicia and a specimen from Albany are the only ones which have come to notice for the State.

Bythoscopus fenestratus Fitch

Athysanus fenestratus Fitch. Homop. N. Y. State Cab. 1851. p. 60; Fitch, reprinted in Lintner. 9th Rep't. 1893. p. 400; N. Y. State Agric. Soc. Trans. 1858. 18: 853

Bythoscopus fenestratus Walker. Homop. 1852. 4: 1162

Pediopsis fenestratus Van Duzee. Can. Ent. 1889. 21: 9

Type in the New York Museum is faded but the hyaline spots of wing arranged in accord with cells is evident. Specimen in the National Museum has only elytra and wings remaining but shows clearly five hyaline cells in disk and anteapical area of elytra.

Bythoscopus pruni Prov.

Bythoscopus pruni Prov. Pet. Faune Ent. Can. 1890. 3: 290; Van Duzee, Am. Ent. 1890. 6: 226

Bythoscopus pruni Van Duzee. Buf. Soc. Nat. Hist. Bul.5, p. 195

Van Duzee records for Buffalo "one spec." and reports it for Lake Placid. Specimens in hand from Albany. National Museum material includes representative of typical form and varieties a, b, d and e. The color is brownish, the cells subhyaline specially in varieties a and b. It is smaller than fenestratus.

Bythoscopus minor Fitch

Bythoscopus minor Fitch. Homop. N. Y. State Cab. 1851. p. 60; Fitch, reprinted in Lintner. 9th Rep't. 1893; p. 400; N. Y. Agric. Soc. Trans. 1858. 18: 583

Bythoscopus minor Walk. Homop. 1851. 3: 876; Van Duzee, Am. Ent. 1890. 6: 227; Psyche. 1890. 5: 390; reprinted in Lintner. 9th Rep't. 1893. p. 410

Bythoscopus minor Van Duzee. Buf. Soc. Nat. Hist. Bul. 4, p. 195

Recorded for Buffalo and reported for Lake Placid by Van Duzee.

Bythoscopus nigrinasi Fitch

Athysanus nigrinasi Fitch. Homop. N. Y. State Cab. 1851. p. 61; reprinted in Lintner. 9th Rep't. 1893. p. 401

Bythoscopus nigrinasi Walker. Homop. 1852. 4: 1162; Van Duzee, Am. Ent. 1890. 6: 228; Psyche, 1890. 5: 390; reprinted in Lintner. 9th Rep't. 1893. p. 410

"June to August. Abundant everywhere on hornbeam" [Van Duzee, Buf. Hemip. p. 195].

Bythoscopus distinctus Van Duzee

Bythoscopus distinctus Van Duzee. Am. Ent. 1890. 6: 224
Bythoscopus distinctus Van Duzee. Buf. Soc. Nat. Hist. Bul. 5, p. 195

Given by Mr Van Duzee for Buffalo and vicinity.

Bythoscopus fagi Fitch

Athysanus fagi Fitch. Homop. N. Y. State Cab. 1851. p. 61; Fitch, reprinted in Lintner. 9th Rep't. 1893. p. 401
Bythoscopus fagi Walk. Homop. 1852. 4: 1162; Van Duzee, in Lintner. 9th Rep't. 1893. p. 410

Specimens which I have referred to this species are of a uniform deep brown color, somewhat larger than fenes altus. The type appears to be lost.

Pediopsis trimaculata Fitch

Pediopsis trimaculata Fitch. Homop. N. Y. State Cab. 1851. p. 60
Bythoscopus trimaculata Walk. Homop. B. M. 1852. 4: 1162
Pediopsis insignis V. D. Review, Am. Ent. 1889. 5: 171
Pediopsis trimaculata Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 7: 116

Recorded for Highland [Felt coll.], Gowanda, Hamburg [Van Duzee, Buf. Hemip. p. 195].

Pediopsis viridis Fitch

Pediopsis viridis Fitch. Homop. N. Y. State Cab. 1851. p. 59; reprinted in Lintner. 9th Rep't. 1893. p. 399

Reported for Karner [N. Y. State Mus.]. I took it at Hamburg, July 8, 1904, from Salem, Aug. 14, 1904, and Van Duzee reports it for Lake Placid.

Type in Fitch collection in New York State Museum, is a female and our specimens agree except that the type has faded. Also reported for Buffalo [Van Duzee, Buf. Hemip. p. 195].

A frequent insect on willows though it will escape attention unless beaten from the twigs as its color blends perfectly with that of the leaves.

Pediopsis canadensis Van Duzee

Pediopsis florescens Van Duzee. Am. Ent. Review. 1889. p. 173
Pediopsis canadensis Van Duzee. Can. Ent. 1890. 22: 111

Reported for Lancaster [Van Duzee, Buf. Hemip. p. 195] and Lake Placid.

Pediopsis bifasciata Van Duzee

Pediopsis bifasciata Van Duzee. Am. Ent. Review. 5: 173
Pediopsis trimaculata Van Duzee. Am. Ent. Review. 5: 172

Pediopsis bifasciata Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 7: 118

Aside from the New York record by Van Duzee under the name trimaculata, I have seen specimens from Karner in the New York collection and secured others at Salem that I believe must be placed here though they vary from typical examples. Occurs on cottonwood and poplar.

Pediopsis suturalis O. & B.

Studies of N. Am. Jassoidea. Pr. Dav. Acad. Nat. Sc. 7: 67.

Reported for Colden N. Y. (VanDuzee, collecter) in original description.

Pediopsis reversalis O. & B.

Studies of N. Am. Jassoidea. Pr. Dav. Acad. Nat. Sci. 7: 69.

Collected at Colden N. Y. by Mr E. P. VanDuzee.

Pediopsis basalis Van Duzee

Pediopsis basalis Van Duzee. Am. Ent. Review. 1889. p. 171; Cat., p. 260; Prov., Pet. Faune Ent. Can. 1890. 3: 295

Pediopsis fumipennis G. & B. Hemip. Colorado, p. 73

Reported for Buffalo [Van Duzee, Buf. Hemip. p. 195] and Lake Placid.

This is a fairly distinct species and fully characterized by the describer. The dark color of the base of clavus is the most striking character.

Pediopsis virescens var. graminea Fabr.

Body slender, sides parallel. Color, light green, a bright black spot at tip of vertex and one on base of hind tibia.

Length of female, 4.5 mm to tip of elytra.

Head strongly produced, vertex very narrow. Front broad, sutures indistinct, pronotum subangular anteriorly, deeply concave posteriorly. Elytra weak, transparent; nervures distinct.

Color. Light green. Head and wings somewhat yellowish. Extruded portion of ovipositor orange. A bright round black spot at apex of vertex and base of hind tibia. Eyes embrowned.

Genitalia. Female, last ventral segment narrowing posteriorly, indented posteriorly. Pygofer broad, not reaching tip of ovipositor.

Two specimens, females, collected on willow at Fitch Point, near the Fitch home, Salem N. Y., Aug. 14, 1904.

They agree so perfectly with the descriptions of var. graminea of the European species virescens that it seems safe to so refer it.

This is the first instance of any European species of this genus being found in America.

Idiocerus pallidus Fitch

Idiocerus pallidus Fitch. Homop. N. Y. State Cab. 1851. p. 59

Bythoscopus pallidus Walker. Homop. 4: 1162

Idiocerus obsoletus Walker. Homop. 1851. 3: 873

Collected in Buffalo during July and August [Van Duzee, Buf. Hemip. p. 194].

I took it also at Hamburg and Van Duzee reports it for Lake Placid.

This also occurred pretty abundantly on willows at Salem. The types are wanting in New York collection. The National Museum collection contains a specimen of the typical form and of varieties "a" and "b." Specimens collected at Fitch Point, Salem that agree with the description and come from Fitch's locality have the pallid greenish color, the spots on vertex and a length of 5.5 mm.

Idiocerus nervatus Van Duzee

Buf. Soc. Nat. Sci. Bul. 5. 1894. p. 194; Cat., p. 261

Reported for Albany [N. Y. State coll.] Staten Island and Lancaster [Van Duzee].

Idiocerus alternatus Fitch

Idiocerus alternatus Fitch. Homop. N. Y. State Cab. 1851. p. 59

Bythoscopus alternatus Walk. Homop. 1851. 3: 876

Idiocerus alternatus Van Duzee. Can. Ent. 1889. 21: 8; Psyche, 5: 388

Idiocerus alternatus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5; p. 194

The Fitch type in New York State collection somewhat faded, is easily identifiable. The National Museum collection contains 6 specimens, one with original Fitch label and varieties a. b and c, none of them however with numbers to connect them with manuscript or published description. They agree with the specimens generally recognized under this name and which have been fully described in recent papers.

A common species over a wide range of country, occurring on willows. I secured specimens at Fitch Point, Salem, also at Hamburg.

Idiocerus suturalis Fitch

Idiocerus suturalis Fitch. Homop. N. Y. State Cab. 1851. p. 59

Bythoscopus suturalis Walk. Homop. 1852. 4: 1162

Idiocerus suturalis Van Duzee. Can. Ent., 21: 8; Psyche, 5: 388

Idiocerus suturalis Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 194

I found it fairly common on willows at Salem and took it also at Hamburg. Van Duzee reports it for willow, poplar and birch. A specimen from Karner is in the New York State collection and Van Duzee reports it for Lake Placid and Phoenicia.

There is no type specimen in the New York State collection but in the National Museum there is a specimen with label, "Idiocerus suturalis Fitch, New York" evidently in Fitch's handwriting. The label "Fitch type" has been added in recent years. This specimen has the dusky sutural border without an interruption.

Idiocerus suturalis var. lunaris Ball

Occurs with the typical form on willows. Van Duzee reports it for Lake Placid and I took it commonly at Salem and elsewhere.

Idiocerus crataegi Van Duzee

Can. Ent. 1890. 22: 110; Buf. Soc. Nat. Sci. Bul. 5, p. 194

Collected at Buffalo on thornbushes [Van Duzee]. Apparently less widely distributed than some of the other species.

Idiocerus lachrymalis Fitch

Idiocerus lachrymalis Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398; Van Duzee, Can. Ent. 1889. 21: 8; Psyche. 1890. 5: 388

Bythoscopus lachrymalis Walk. Homop. 1851. 4: 1161

Abundant at Salem on poplar. I secured a large series of this species from a little patch of scrubby poplars on the crest of a hill near Salem on Aug. 14. They agree perfectly with the well preserved types in the New York State Museum and fit the Fitch description which for this species is quite distinctive. Mr Van Duzee secured it at Lake Placid and Phoenicia and has heretofore reported it for Lancaster and Hamburg. A single specimen in the National Museum is representative for the typical form, while the New York State collection includes representatives for the varieties under numbers and letters precisely as given in the published description.

Idiocerus maculipennis Fitch

Idiocerus maculipennis Fitch. Homop. N. Y. State Cab. 1851. p. 59

Bythoscopus maculipennis Walk. Homop. 1852. 4: 1161

Idiocerus maculipennis Van Duzee. Psyche, 5: 388

Idiocerus maculipennis Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 194

Collected in July and August on thorn [Van Duzee] and at Mosholu [Bueno]. Fitch's description is represented now by fragments of broken specimens in the National Museum. A full recent description is given in a paper on the Genus Idiocerus [Osborn and Ball, Dav. Acad. Nat. Sci. Proc. 7: 73].

Idiocerus provancheri Van Duzee

Idiocerus provancheri Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 194

Bythoscopus clitellarius Prov. Pet. Faune Ent. Can. 1890. 3: 288

Idiocerus provancheri Van Duzee. Can. Ent. 1890. 23: 111

Collected at Buffalo and Lake Placid [Van Duzee] and Severence [N. Y. State coll.]. Occurs on different species of Crataegus.

Idiocerus verticis Say

Jassus verticis Say. Acad. Nat. Sci., Phila. Jour. 1831. 6: 308

Bythoscopus verticis Uhler. U. S. Geol. & Geog. Sur. Bul. 3. 1877. p. 465

Idiocerus verticis Van Duzee. Psyche. 1890. 5: 389

I took at Salem one specimen which agrees much better with this species than with alternatus. Previous records place the species west of the Mississippi river.

Genus AGALLIA Curtis

Agallia 4-punctata Prov.

Bythoscopus 4-punctatus Prov. Nat. Can. 1872. 4: 376
Agallia 4-punctata Van Duzee. Am. Ent. 1889. 5: 167
Agallia 4-punctata Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 196

Records for Poughkeepsie [N. Y. State coll.], Ithaca [Cornell coll.], Buffalo [Van Duzee], Forest Park, June 7, 1902 [Bueno].

I collected it at Cold Spring Harbor and Jamaica; Van Duzee at Lake Placid in 1904.

Agallia sanguinolenta Prov.

Bythoscopus sanguinolentus Prov. Nat. Can. 1872. 4: 376
Agallia sanguinolenta Van Duzee. Am. Ent. 1889. 5: 166
Bythoscopus siccifolius Uhler. U. S. Geol. & Geog. Sur. Bul. 2, p. 359
Agallia siccifolia Van Duzee. Can. Ent. 1889. 21: 9; Buf. Soc. Nat. Sci. Bul. 5, p. 196

Generally distributed over the State as well as elsewhere over the United States. Records for Ithaca [Cornell Univ.], Buffalo [Van Duzee], Karner [N. Y. State coll.], Mosholu, Oct. 1, 1902. [Bueno].

I collected it at Eagle Bridge, Nassau, Jamaica and Cold Spring Harbor, and Mr Van Duzee reports it for Lake Placid, Phoenicia, Staten Island and Jamaica.

Agallia novella Say

Jassus novellus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 309
Agallia novellus Van Duzee. Can. Ent. 21: 8; Buf. Soc. Nat. Sci. Bul. 5, p. 196

Reported for Buffalo Van Duzee, Buf. Hemip. p. 196.

Recorded for Buffalo and reported in 1904 for Lake Placid and Phoenicia but doubtless well distributed over the State.

Agallia constricta Van Duzee

Can. Ent. 26: 90; Osborn and Ball, Dav. Acad. Nat. Sci. Proc. 7: 52

Aside from the record of Long Island given in the review of this genus by Osborn and Ball, I have specimens collected at Cold Spring Harbor in August 1904, and Mr Van Duzee reports it for Staten Island. Its distribution is evidently to the southward and Long Island is probably about its northern limit.

Family TETTIGONIDAE

Genus ONCOMETOPIA

Oncometopia undata Fabr.

Proconia undata Fabr. [For full synonomy *see* Van Duzee's *Catalogue*]

The general range for this species is stated by Van Duzee as New Jersey to Michigan and south to Florida and Mexico. Only one record "Oswego" given on a specimen in the N. Y. State Museum collection has come to notice for the State.

Oncometopia lateralis Fabr.

Cicada lateralis Fabr. Ent. Syst. sup. p. 524
Cicada marginella Fabr. Syst. Rhyng. p. 96
Cicada costalis Fabr. Syst. Rhyng. errata following p. 314
Oncometopia lateralis Ball. Ia. Acad. Sci. Proc. 8: 44

This is a northern form and the only trustworthy record I know for the State is from Mr Van Duzee who reports it for Lake Placid. I have specimens from Montreal Can. and it may be expected to occur over the northern part of the State.

Genus AULACIZES

Aulacizes irrorata Fabr.

Cicada irrorata Fabr. Ent. Syst. 1794. 4: 33
Cicada nigripennis Fabr. Ent. Syst. 1794. 4: 32
Aulacizes rufiventris Walk. Homop. 1851. 3: 796
Aulacizes guttata Uhl. Stand. Nat. Hist.; Van Duzee, Cat. [nec. Sign.]
Aulacizes pollinosa Fowl. Biol. Homop. 2: 218, pl. 15, fig. 18

A specimen secured at Cold Spring Harbor. One also in the American Museum, New York city and credited to "N. Y." and it was very likely secured at some point near the city. This is also a southern species but its distribution extends a little farther north than that of the preceding species.

Genus TETTIGONIA

Tettigonia bifida Say

Tettigonia bifida Say. Acad. Nat. Sci. Phila. Jour. 1831. 4: 313
Tettigonia tenella Walk. Homop. 1851. 3: 770
Tettigonia fasciata Walk. Homop. 1851. 3: 780
Tettigonia bifida Osborn & Ball. Ia. Acad. Sci. Proc. 1897. 4: 175; Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 196

Reported for Ithaca. [Cornell Univ.]. Keene Valley, [N. Y. State coll]. New York city, Sep. 2, 1902. [Bueno]. Phoenicia, Buffalo. [Van Duzee].

A fairly common species and examples were taken during my trip at Hamburg, Salem, Cold Spring Harbor and Jamaica. It occurs in wooded localities and is found on grasses and other low herbaceous plants.

Tettigonia gothica Sign.

Tettigonia gothica Sign. Ann. Soc. Ent. Fr. 1854. p. 345
Tettigonia hieroglyphica, in reference from Eastern states [nec. Say].
Tettigonia similis Woodw. Ill. State Lab. Bul. 3. 1887. p. 25

Keene Valley, Karner, Clinton Heights. I took it at Salem, Nassau, and Oyster Bay. Mr Van Duzee at Lake Placid, Phoenicia and Kingston.

As Ball has pointed out this species must have been the basis for records of hieroglyphica in localities east of Illinois.

It is light reddish or grayish green, the head with several lines on the vertex doubled on each other and nearly parallel with median line, and prominent spot at apex black. Length 5.5 mm to 6 mm.

It occurs in great numbers in the undergrowth along the margin of thickets and may be collected by thousands in almost any suitable locality.

The larva is light yellow with a dark stripe on each side, a broad median stripe light, narrowing at tip of vertex and on last segment of abdomen. Eye black anteriorly and posteriorly with vertical yellow band including black dot. Beneath with eyes light greenish yellow, tips of tarsi black. Collected on hill near Salem N. Y., on Aug. 15, 1904.

Tettigonia tripunctata Fitch

Tettigonia tripunctata Fitch. Homop. N. Y. State Cab. 1851. p. 55
Not Tettigonia tripunctata Sign. Monogr. 175; Fowler, Biol. p. 253

In collections at Ithaca [Cornell Univ.], Albany, Mosholu and Phoenicia.

This is so distinct and well marked a species that it has never been in doubt and the types are still in fair state of preservation. The whitish color with light brown stripes and three conspicuous black dots on the head at once characterize it. While not an abundant species in collections it is pretty generally distributed and I secured specimens during August at Salem, Jamaica and Staten Island and Mr Barber has sent a specimen from Cold Spring Harbor.

DIEDROCEPHALA Spinola

Diedrocephala coccinea Forst.

Cicada coccinea Forst. Nov. Sp. Ins. 1781. p. 96
Tettigonia quadrivittata Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 312
Tettigonia picta Walk. Homop. 1851. 3: 158
Tettigonia teliformis Walk. Homop. 1851. 3: 764
Diedrocephala coccinea Osborn & Ball. Ia. Acad. Sci. Proc. 1897. 4: 177
Tettigonia quadrivittata Fowl. Biol. Homop. 1900. 2: 276, pl. 18, fig. 22

New York, Mosholu, Buffalo, Ithaca, Albany, Salem, Poughkeepsie, Wilmington, Saranac Inn, Lake Placid, Keene Valley, Forest Park. I took it at Hamburg, Nassau, Salem, Eagle Bridge,

Oyster Bay, Jamaica and Staten Island, mostly adults but a few larvae during 9th to 22d of August. Buffalo, "especially on blackberry bushes" [Van Duzee].

One of the most beautiful of the Tettigonids, having brilliant yellow color with bright red and blue or green stripes. An abundant species over the entire eastern United States and occurring on a variety of forest plants. The larvae are yellow with dark wing pads and found in July and August.

DRAECULACEPHALA Ball

Draeculacephala mollipes Say

Tettigonia mollipes Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 312
Tettigonia innotata Walk. Homop. 1851. 3: 770
Tettigonia antica Walk. Homop. 1851. 3: 771
Tettigonia producta Walk. Homop. 1851. 3: 772
Tettigonia acuta Walk. Homop. 1851. 3: 773
Acopsis viridis Prov. Nat. Can. 1872. p. 352
Diedrocephala mollipes Osborn & Ball. Ia. Acad. Sci. Proc. 1897. 4: 176
Tettigonia mollipes Fowl. Biol. Homop. 1900. 2: 273, pl. 18, fig. 15
Aulacizes lineata Fitch. Mss.
Draeculacephala mollipes Ball. Ia. Acad. Sci. Proc. 8

Hamburg, Buffalo [Van Duzee], New York [Fitch], New York city [Bueno], Albany Karner, Poughkeepsie [N. Y. State Mus.], Ithaca [Cornell Univ.], Phoenicia [Van Duzee].

I took it at Hamburg, Nassau, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica and Staten Island and it may be expected in all parts of the State.

An almost universal species, occurring in grasses and often in such numbers as to be an undoubted source of injury.

Draeculacephala angulifera Walk.

Tettigonia angulifera Walk. Homop. 3: 771
Diedrocephala angulifera Van Duzee. Ent. News. 5: 156
Diedrocephala sp. Southwick. Science. 19: 318
Draeculacephala angulifera Ball. Ia. Acad. Sci. Proc. 8: 69

Aside from records of "New York" given by both Van Duzee and the record by Mr Southwick, I know of no records for the State.

The species is larger than mollipes with a shorter, blunter vertex.

Draeculacephala novaeboracensis Fitch

Aulacizes novaeboracensis Fitch. Homop. N.Y. State Cab. 1851. p. 56
Tettigonia prasina Walk. Homop. 1851. 3: 768
Diedrocephala mollipes Prov. Pet. Faune Ent. Can. 1889. 3: 266
Diedrocephala novaeboracensis, Osborn & Ball. Ia. Acad. Sci. Proc. 1897. 4: 177, 189

Keene Valley, Lake Placid, Piseco lake, Nassau and Cold Spring Harbor.

I found it abundant at Salem in low sedgy localities and these specimens agreed perfectly with the Fitch specimens.

The types are well preserved.

Helochara communis Fitch

Helochara communis Fitch. Homop. N. Y. State Cab. 1851. p. 56
Tettigonia herbida Walk. Homop. 1851. 3: 769.

Swept at Salem, Aug. 15, 1904, in large numbers on swampy land. Adults and larvae also taken at Eagle Bridge and New York State Museum records show it for Albany, Nassau, Karner, Buffalo, Phoenicia, Kingston, Staten Island, etc. The types though faded are unmistakable.

This is a very widely distributed species and is certain to be found in every locality in the State where grassy swamp land is present. It doubtless serves to reduce the growth of the grass where it occurs since it frequently swarms in immense numbers but as it works on places having an abundance of moisture, the effects of the drain are not specially noticeable.

Eucanthus acuminatus Fabr.

Cicada acuminata Fabr. Ent. Syst. 1794. 4: 36, 40
Euacanthus orbitalis Fitch. Homop. N. Y. State Cab. p. 57
Euacanthus acuminatus Osborn & Ball. Ia. Acad. Sci. Proc. 4: 182

This insect has a wide distribution in Europe and America and no essential differences can be detected between the Old World form and ours described by Fitch under the name orbitalis. Van Duzee reports it for Lake Placid.

Xerophloea viridis Fabr.

Cercopis viridis Fabr. Ent. Syst. 1794. 4: 13, 50
Xerophloea grisea Germar. Zeits. F. G. Entom. I, 1901, 1839.
Xerophloea virescens Stal. Öfvers Vet. Akad's Förh. 1854. p. 30, 94
Xerophloea viridis Fabr. Stal., Hemip. Fabriciana. 2: 59
Parapholis peltata Uhler. U. S. Geol. & Geog. Sur. Bul. 1877. 3: 461
Xerophloea peltata Uhler. Stand. Nat. Hist. 1884. 2: 248
Xerophloea viridis Osborn & Ball. Ia. Acad. Sci. Proc. 4: 179

I have received specimens from Mr Bueno taken at Mosholu, July 26, 1902, and Mr Van Duzee reports it for Kingston.

It appears to be recorded so far only for the southern part of the State.

Xerophloea major Baker

Xerophloea major Baker. Psyche, 3: 285

A specimen referred here has been received from Mr J. R. de la Torre Bueno, collected at Mosholu near New York city; also a male and female from Cold Spring Harbor from Mr H. G. Barber.

Gypona octo-lineata Say

Tettigonia octo-lineata Say. Compl. Wr. 2: 257
Gypona striata Burmeister. Gen. Ins. pl. 16, no. 9
Gypona flavilineata Fitch. Homop. N. Y. State Cab. p. 57
Gypona quebecensis Provancher. Nat. Can. 4: 352
Gypona cana Burm. Gen. Ins. pl. 16, no. 10
Gypona flavilineata. Spangberg. Spec. Gyponae, p. 8

Reported for Mosholu, July 26, 1902 [Bueno], Keene Valley, Hamburg, Hope [N. Y. State Mus.].

A widely distributed and extremely variable species. Some of the forms seem fairly constant and have been named as distinct species with what propriety is still a matter of dispute. Salem, Hamburg, Jamaica, Karner.

Gypona bipunctulata Woodw.

Gypona bipunctulata Woodworth. Ill. State Lab. Nat. Hist. Bul. 3. 1887. p. 30(♀)

Gypona nigra Woodworth. Ill. State Lab. Nat. Hist. Bul. 3. 1887. p. 31 (♂)

Reported for Mosholu, Staten Island [Bueno].

Gypona melanota Spang.

Gypona melanota Spang. Spec. Gyponae. 1878. p. 23

Reported for Staten Island [Bueno].

This may be a melanotic form of bipunctulata Woodw. in which case this name has priority.

Gypona scarlatina Fitch.

Gypona scarlatina Fitch. Homop. N. Y. State Cab. 1851. p. 57; reprinted in Litner. 9th Rept. 1893. p. 397; Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 197

This has been a rare species in recent years judging by the small number of specimens that have passed through my hands. Van Duzee mentions it for Buffalo as "Occasional on hickory trees through July and August."

Gypona rugosa Spangb.

Gypona rugosa Spangb. Spec. Gyponae, p. 6

One specimen swept from whortleberry bushes in pine barrens near Oyster Bay, Aug. 18, 1904, is referred to this species on the strongly rugose character of the elytral veins. The species was originally described from Mexico and the female measurements given as 9 mm for body, 12 mm with elytra. This specimen is smaller, 8 mm for body and 10 mm to tip of elytra.

Gypona geminata n. sp.

Similar to octolineata but without distinct stripes. Head shorter, color deep green, length of female 8.5-9 mm, male 8 mm.

Vertex twice as wide as length at middle, front nearly round or very faintly parabaloid, the ocelli situated at middle and as far from each other as from eye. Front depressed, clypeus scarcely longer than wide; pronotum nearly twice as long as vertex, hind border concave, surface whitish transversely striate except on anterior border; anterior femora beneath and outer portions of tibiae with series of strong setae. Scutellum of deep curved line; elytra opaque, clavus not reticulate but with series of punctures parallel to the veins, corium reticulate beyond apex of clavus. Costal border whitish.

Color deep green, slightly tinged with orange but without definite orange or red stripes; ocelli and eyes bright red, beneath uniformly green, tarsal claws embrowned.

Genital segment of female narrowed to apex, slightly longer laterally than preceding segment, posterior border concave, simple. Male valve not visible, plates slender, bluntly pointed, extending to tip of pygofer.

Specimens of this species were beaten from pinetrees at Oyster Bay, Long Island. They differ distinctly from octolineata and I have been unable to refer them to any described species and have therefore stated the distinctive characteristics under above name.

Genus PENTHIMIA Germ

Penthimia americana Fitch

Penthimia americana Fitch. Homop. N. Y. State Cab. 1851, p. 57; reprinted in Lintner. 9th Rep't. 1893. p. 397
Penthimia vicaria Walk. Homop. 1851. 3: 841 (♂)
Penthimia picta Prov. Nat. Can. 1872. 4: 352
Penthimia americana Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 197

This insect is noteworthy on account of its strong resemblance to species of the family Cercopidae. The color varies from red to black. It is seldom found in abundance but probably occurs in all parts of the State. Hickory, maple and other trees or shrubs are its food plants.

Family Jassidae

Genus STRONGYLOCEPHALUS Flor.

Strongylocephalus agrestis Fall.

Cicada agrestis Fallen. Acta. Holm. 1806. 27: 23
Selenocephalus agrestis Burm. Gen. Ins. 1. 1840. pl. 12
Strongylocephalus agrestis Flor. Rhynch. Livl. 1861. 2: 210
Strongylocephalus agrestis Van Duzee. Buf. Soc. Nat. Hist. Bul. 5, p. 197 (1894).

This is evidently very rare in New York as the only record of its occurrence is based on a single specimen collected by Mr Van Duzee "from a swampy meadow at East Concord, May 18, 1889."

Genus ACOCEPHALUS Germ.

Acocephalus striatus Linn.

Acocephalus striatus Linn. *See* Walker, Homop. 3: 848 for synonymy; Edwards, Lond. Ent. Soc. Trans. 1888. p. 19; Puton, Cat. Hemip. Palae. 1886. p. 79.
Acocephalus nervosus Schrank. Uhler. Stand. Nat. Hist. 1884. 2: 247

This is an Old World species and is credited to New York by Mr Van Duzee but without specific locality. I have specimens from Maine and it is recorded also for Canada.

Acocephalus flavostriatus Donov.

A. flavostriatus Donov. Brit. Ins. 1799
A. rivularis Germar. Mag. Ent. 1821. p. 89
A. flavostrigatus Sign. Essai sur le Jassides, p. 39

I took one specimen at Eagle Bridge, Aug. 13, 1904, and Mr Van Duzee has sent me a specimen which he secured at Phoenicia, Aug. 25, 1904.

It is a European species not hitherto recorded for America though I have a specimen from Dr C. M. Weed, collected at Woodstock Vt.

Acocephalus albifrons Linn.

Acocephalus albifrons Linn.
Tettigonia mixta Say. Acad. Nat. Sci. Phila. Jour. 1825. 4: 341; reprinted in Compl. Wr. 2: 258; Walker, Homop. 1852. 4: 1157 (mention)
Acocephalus mixtus Van Duzee. Psyche, 1890. 5: 390; Southwick, Science. 1892. 19: 318

This is another species distributed in both the old and new world but which has stood under separate names for the two regions.

It is quite dark and nearly black for the female, the male lighter brown with whitish or transparent spots in the elytra.

It has been recorded for New York city by Southwick and Buffalo by Van Duzee and collected at Salem [H. O.] Hamburg and Phoenicia [Van Duzee] and Cold Spring Harbor [Barber].

Genus XESTOCEPHALUS Van Duzee

Xestocephalus pulicarius Van Duzee

Xestocephalus pulicarius Van Duzee. Buf. Soc. Nat. Sci Bul. 5. 1894. p. 215.

Aside from the localities mentioned in the original description, Buffalo and New York city, this species has been collected at Jamaica and Phoenicia, in August.

It is doubtless generally distributed over the State in suitable localities where its food plant, Carex vulpinoidea, is present.

Xestocephalus fulvocapitatus Van Duzee

Xestocephalus fulvocapitatus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5. 1894. p. 25

Van Duzee in his description records this species for Lancaster. "In company with the preceding (pulicarius) of which it may prove a variety."

Genus PARABOLOCRATUS Fieb.

Parabolocratus viridis Uhler

Glossocratus viridis Uhler. U. S. Geol. & Geog. Sur. Bul. 3. 1877. p. 462
Parabolocratus viridis Uhler, Stand. Nat. Hist. 1884. 2: 247; Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 198

Common over wide extent of United States. Recorded for vicinity of Buffalo and Jamaica [Van Duzee].

Genus SPANGBERGIELLA

Spangbergiella vulnerata Uhler

Glossocratus vulneratus Uhler. U. S. Geol. & Geog. Sur. Bul. 3, p. 464
Spangbergiella vulneratus Sign. Am. Soc. Ent. Fr. ser. 5, 9: 274

Two specimens of this rare form have been noted in the National Museum labelled "N.Y." It is a southern species and while we might expect it to be found on Staten Island or Long Island it seems hardly probable that it will be found to occur further north.

Genus PARAMESUS Fieb.

Paramesus vitellinus Fitch

Acocephalus vitellinus Fitch. Homop. N. Y. State Cab. 1851. p. 57. reprinted in Lintner. 9th Rep't. 1893. p. 397; Van Duzee. Can. Ent. 1889. 91:9
Selenocephalus vitellinus Ashm. Smith, Ins. N. J. 1890. p. 445; Van Duzee. Psyche. 1890. 5:390
Parabolocratus vitellinus Southwick. Science. 1892. 19:318
Paramesus vitellinus Van Duzee. Am. Ent. Soc. Trans. 21:290

To the original description we may add that the species is to be distinguished from its allies by the bright fulvous color with yellowish transparent round spots and the short rather thick and scarcely notched median process of the last ventral segment in the female. It is a handsome species but usually rare. It was probably secured by Dr Fitch in the vicinity of Salem and Van Duzee has recorded it for Buffalo and reports it for Lake Placid.

Genus PLATYMETOPIUS Burm.

Platymetopius acutus Say.

Jassus acutus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6:306; reprinted in Compl. Wr. 1869. 2:382; Fitch, Homop. N. Y. State Cab. 1851. p. 62 (mention); reprinted in Lintner. 9th Rep't. 1893. p. 402
Platymetopius acutus Uhler. U. S. Geol. & Geog. Sur. Bul. 1877. 3:473; Van Duzee, in Lintner. 9th Rep't. 1893. p. 410

Say's description of this species is quite accurate and fortunately no synonyms have been created.

It is an abundant species from Maine to the Rocky mountains and in New York has been recorded for Buffalo and collected the past summer at Karner [Felt], Salem, Eagle Bridge, Cold Spring Harbor and Jamaica by myself, Lake Placid, Phoenicia and Kingston by Van Duzee.

Platymetopius cuprescens n. sp.

Form of a c u t u s , face entirely yellow, color more coppery, elytral spots less numerous or indistinct. Length of female, 5 mm.

Vertex long, acute, about twice as long as width between eyes, front long narrowed at apex, clypeus widening gradually from basal fourth. Pronotum about two thirds as long as vertex, hind border slightly emarginate, elytra flaring at tips, with a few hyaline spots near apex and in costal border.

Color. Vertex brownish with dark elytral area, a narrow wedge-shaped apical line and two narrow spots on the disk of vertex. Face entirely yellow, eyes brownish, pronotum coppery brown, a faint median line and lateral border yellowish. Scutellum brown with yellowish discal spots and two short parallel lines on apical portion. Elytra coppery with rather faint dark ramose lines and minute dots and reflexed veinlets fuscous, yellowish hyaline spots on base of apical cells, apex of anteapical cells. Costal space subhyaline, beneath yellowish with fuscous markings on abdominal segments and dots on tibiae.

G e n i t a l i a. Last ventral segment of female elongate, narrowed and rounded at apex with another prominent carina on posterior half, pygofers reaching nearly to tip of ovipositor.

A single specimen collected by Mr E. P. Van Duzee at Phoenicia N. Y. It resembles a c u t u s in size and shape, the hyaline spots much less pronounced, lacks the brown borders of face and has a distinctly carinate female ventral segment. From l a t u s Baker which it resembles in genital segment, it differs in being darker, more coppery, elytra more hyaline on costa, the profile of head not so curved.

Platymetopius frontalis Van Duzee

P l a t y m e t o p i u s f r o n t a l i s Van Duzee. Can. Ent. 1890. 22:112; Southwick, Science. 1892. 19:318; Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 198

P l a t y m e t o p i u s a l b o p u n c t a t u s Fitch. Ms Ashm.; Smith. Cat. Ins. N. J. 1890. p. 445

Specimens have been noted in the collections for Poughkeepsie, Karner, New York city, Mosholu and Cold Spring Harbor. It was recorded for Buffalo by Mr Van Duzee who says: "With a c u t u s , but much less abundant. June to Sep. most frequently on oak bushes." He reports it in 1904 from Phoenicia, Kingston and Staten Island.

Apparently much more abundant in recent years. Plentiful in 1904 on oaks. Probably a grass feeder but collecting on oaks at maturity.

It is readily separated from a c u t u s by the smaller size, darker color, and strong contrast of bright yellow front against the dark border of face. I collected it last summer at nearly every point where collections were made—Hamburg, Eagle Bridge, Nassau, Salem, Cold Spring Harbor, Jamaica and Staten Island and at all places it seemed more plentiful than a c u t u s. It must have been very rare to have escaped Dr Fitch's attention during his work a half century ago.

Platymetopius obscurus Osborn

Ohio Nat. 5: 274

Taken at Cold Spring Harbor August 1904.

Platymetopius angustatus n. sp.

Slender; light olivaceous green, length of female 4 mm.

Vertex acutely pointed nearly twice as long as width between eyes. Front very narrow, tapering to clypeus, long, slender, twice as long as wide, apex rounded, lorae, elongate nearly reaching margin of genae, pronotum strongly arched in front a little more than half as long as vertex, posterior margin slightly sinuate. Scutellum large, median impression deep, strongly curved, elytra truncate at apex, costal cells hyaline.

Color. Light greenish olivaceous somewhat tinged with cupreus; vertex with dusky lines somewhat diverging toward apex and front light yellowish green, more greenish at apex where there are three angular lines extending to border of the front; ocelli yellow, eyes black, pronotum greenish mottled with dusky, elytra greenish coppery with round hyaline spots in anteapical and apical cells; dorsum of abdomen black, margins yellow; costal cells hyaline, margined with black, beneath yellowish green, legs pale, base of spines and the tarsal claws dusky.

Genitalia. Last ventral segment of female rounded behind, pygofers reaching tip of ovipositor. What appears to be the male of this species collected at the same time and from the same trees differs from the above described in that the vertex is shorter, less acute, about 1½ times as long as width between the eyes, the angular lines on front somewhat less conspicuous. The color more inclined to yellowish. The pronotum, scutellum and elytra somewhat more coppery, the genitalia having the valve large, convex, posterior border angulate, plates triangular, short, about ½ length of pygofers. Length 3.75 mm. Described from one female and five male specimens beaten from pinetrees, Oyster Bay, Aug. 18, 1904.

Platymetopius fulvus n. sp.

Black, fulvous with scattered white spots on elytra. Length of female 5 mm, male 4.5 mm.

Vertex acute but not very long about 1¼ times as long as width between eyes and about equal to pronotum. Frontal sutures sinuous, clypeus about 1⅔ times as long as wide. Pronotum slightly concave on hind border; scutellum with broad median impression.

Color. Vertex, pronotum, angles of scutellum and elytra bright fulvous with divergent lines on vertex. Five parallel lines on pronotum and numerous dots on elytra whitish. Central portion of scutellum yellow; costal cells hyaline or faintly whitish, beneath lighter, yellowish or pallid.

Genitalia. Last ventral segment of female elongate, posterior border rounded with small black spots close to hind border. Pygofer extending almost to tip of ovipositor, brown. Male valve triangular, hind border with distinct sharp angle.

Described from a number of specimens, 10 females and six males beaten from pine and huckleberry, Oyster Bay, Aug. 18, 1904. As all are adults it is impossible to determine the food plant with certainty though it seems likely that it is the huckleberry and that the individuals taken from pines were resting accidentally on the trees.

Deltocephalus sayi (Fitch)

Amblycephalus sayi Fitch. Homop. N. Y. State Cab. 1851. p. 61; reprinted in Lintner. 9th Rep't. 1893. p. 401

Jassus sayi Walker. Homop. 1852. 4: 1158

Deltocephalus sayi Uhler. U. S. Geol. & Geog. Sur. Bul. 4. 1878. p. 511; Southwick, Science. 1892. 19: 288; Van Duzee, in Lintner. 9th Rep't. 1893. p. 410

Deltocephalus sayi Fitch. Van Duzee, Buf. Soc. Nat. Hist. Bul. 4, p. 198

Reported for Buffalo, Poughkeepsie, Otto, Karner, Lake Placid, Phoenicia and Kingston. I collected it in numbers at Hamburg, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica and Staten Island.

Fitch's types are in fair preservation and represent the small and rather dark form of the species.

Deltocephalus sylvestris O. & B.

Deltocephalus sylvestris Osborn & Ball. Ia. Acad. Sci. Proc. 4: 213

Collected at Lake Placid by Mr Van Duzee.

Deltocephalus minki Fieb.

Deltocephalus minki Fieb Verh. Zool. Bot. Ges. in Wien. 1869 19:217

Reported for Lake Placid [Van Duzee].

Hitherto recorded for Canada and Mr Van Duzee has specimens collected at Lake Placid in the Adirondacks determined by Mr Ball. I collected it at Salem, Eagle Bridge and Cold Spring Harbor.

Deltocephalus apicatus Osborn

Deltocephalus apicatus Osborn. Can. Ent.

This species was found in considerable numbers within a patch of grass (Panicum lanuginosum Ell.) a few rods square at Hamburg N. Y., Aug. 7. I also collected it at Salem at Fitch Point close to Fitch's home place and Mr Van Duzee reports it for Lake Placid.

Deltocephalus flavicosta Stal.

Deltocephalus flavicostatus Van Duzee. Can. Ent. 24:116
Deltocephalus flavicosta Baker. Psyche 8:117

This was found in considerable abundance at points where I collected and specially at Cold Spring Harbor, Salem, Eagle Bridge, Nassau and Jamaica.

The dark color with the bright yellow costal line is very distinctive for this species.

Deltocephalus areolatus Ball

Can. Ent. 31:188

A specimen of this species has been sent to me in a collection of Jassids from Mr J. R. de la Torre Bueno collected in vicinity of New York city and I have one from Mr Van Duzee labelled Woodbine N. J.

Deltocephalus debilis Uhler

Deltocephalus debilis Uhler. U. S. Geol. & Geog. Sur. Bul. 1867. 2:360; Van Duzee, Can. Ent. 1889. 21:11
Deltocephalus debilis Van Duzee. Buf. Soc. Nat. Hist. Bul. 4:198

Reported for Lancaster, Buffalo and Colden, also Lake Placid [Van Duzee].

This is a low ground species and by no means uniform in its occurrence or distribution.

Deltocephalus compactus O. & B.

Deltocephalus compactus Osborn and Ball. Ia. Acad. Sci. Proc. 4: 217

Lake Placid, Phoenicia and Staten Island, collected by Mr Van Duzee. I took it at Cold Spring Harbor.

This is a very small species related to the southern weedi. It has now been recognized from the state of Washington to New York. The short, compact form, rather blunt head and mottled elytra are most apparent characters though in the latter point it resembles inimicus.

Deltocephalus obtectus O. & B.

Deltocephalus obtectus Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 7: 78

Taken at Eagle Bridge, Hamburg and Salem.

This is the first time the species has been recorded from New York. It is however fairly common in certain grasses and on some hillside pastures was abundant enough to be considered an economic factor.

Deltocephalus configuratus Uhler

Deltocephalus configuratus Uhler. U. S. Geol. & Geog. Sur. Bull. 1871. 4: 511

Deltocephalus configuratus Van Duzee. Buf. Soc. Nat. Hist. Bul. 4: 198

Reported for Buffalo and the Adirondacks.

Van Duzee speaks of this as "a common meadow insect from May to August" but except at Hamburg, I found it rare or absent during this summer's trip.

Deltocephalus melsheimeri Fitch

Amblycephalus melsheimeri Fitch. Homop. N. Y. State Cab. p. 61

The Fitch type of this species in the New York State collection is a female in fair state of preservation. It measures 2.5 mm in length, is narrow, the head distinctly pointed, elytra transparent. The female ventral segment margin straight with no teeth or sinuation and very narrowly bordered with black. While much faded it furnishes structural characters of value. The specimens in the National Museum for this species consist of three examples, the first, bearing the original Fitch label "Amblycephalus melshemerii N.Y." is considerably broken with elytra and

end of abdomen present, the latter showing the female genitalia. Elytra are shorter than abdomen, rounded at apex, female segment truncate narrowly black on margin, (indistinct), size agreeing with other specimens. The second specimen bears the original label "var. A." and with added labels "Fitch's type," "Fitch's collection" is all gone but the abdomen. This shows the female ventral segment which is truncate, faintly sinuate with narrow black margin on middle. Fragments of elytra adhering to pin are shorter than abdomen. The third specimen is whole, in fair condition evidently remounted on paper point from the pinned specimen, labelled "Fitch type" "Fitch's collection." This measures nearly 3 mm to end of abdomen. The head is narrow, pointed as in the Albany specimen, elytral tip reaching end of abdomen, female ventral segment truncate with narrow black border. The whole form narrow. It appears to agree so far as parts are present to compare with the Albany specimen. The elytra are all hyaline slightly infuscated in the cells, specially bordering the veins.

I secured specimens at Eagle Bridge, Salem and other points that agree distinctly with these types. It appears from this comparison that the original melsheimerii of Fitch is not the insect that has been placed under this name by Van Duzee and others although the description, except for length, would apply equally as well to both forms.

Deltocephalus affinis Gillette & Baker

Deltocephalus melsheimeri Van Duzee. Am. Ent. Soc. Trans. 21: 292

Deltocephalus affinis Gillette & Baker. Hemip. Colorado, p. 84

This species answers the brief description of melsheimeri perfectly except in the length. The type specimen of melsheimeri in the New York State collection is not only smaller than the average of this form but has a much narrower body and more pointed head as shown in the discussion of that species.

This is widely distributed in the State and during recent years has undoubtedly been a much more abundant species than melsheimeri. It is described fully under the name of melsheimeri in the review of Deltocephalus by Osborn and Ball.

Deltocephalus nigrifrons Forbes

Collected at Hamburg, Aug. 8, 1904, in abundance; also "rare at Lancaster, June to August 1887" [Van Duzee, Buf. Hemip. p. 194].

I have retained the name and limits adopted in the review of the genus Deltocephalus by Osborn and Ball, notwithstanding the difficulty that is felt in adopting this as final.

This has been recorded several times as occurring in immense numbers in oats, lawn grass, etc. but it seems as a rule most abundant in annual grasses like foxtail and panic grasses.

Deltocephalus inimicus Say

Jassus inimicus Say. Am. Acad. Nat. Sci. Phila. Jour. 1831. 6:305; reprinted in Compl. Wr. 1869. 2:382
Amblycephalus inimicus Fitch. Homop. N. Y. State Cab. 1851. p. 61; reprinted in Lintner, 9th Rep't. 1893. p. 401
Tettigonia inimica Walker. Homop. 1852. 4:1158
Deltocephalus inimicus Van Duzee. Can. Ent. 1889. 21:11; Southwick, Science. 1892.. 19:288; Van Duzee, in Lintner 9th Rept. 1893. p. 410
Jassus 6-punctatus Prov. Nat. Can. 1872. 4:378
Deltocephalus inimicus Van Duzee. Buf. Soc. Nat. Hist. Bul. 4:199

Reported for Buffalo, Otto, Lake Placid, Phoenicia, Kingston and Karner. I collected it in numbers at Hamburg, Nassau, Salem, Cold Spring Harbor, Jamaica and Staten Island.

Taken everywhere that collections are made in grass land, at least where blue grass occurs. In many localities it becomes at times a serious pest in grass land and it has also been recorded as a pest in wheat fields.

Genus SCAPHOIDEUS

Scaphoideus consors Uhler

Scaphoideus consors Uhler. Md. Acad. Sci. Trans. 1. 1889. p. 56

Separated from scalaris by broader vertex. Uhler referred this species to New York, Maryland and Texas. It has been seldom noticed probably because of its limitation in food plant.

Scaphoideus sanctus Say ??

I mention under this name a specimen from Cold Spring Harbor sent me by Mr H. G. Barber which differs so much in size and genitalia that it can not be safely referred to either sanctus Say or fasciatus Osborn but still the elytral picture and general facies relates it closely to these species.

While additional specimens will in all probability show it to be distinct it seems undesirable to describe as new with but one sex and but one specimen of that in hand. As stated in my paper on "The Genus Scaphoideus" the real sanctus of Say is in some doubt."

Scaphoideus scalaris Van Duzee

Scaphoideus scalaris Van Duzee. Ent. Am. 6:51

Reported for Phoenicia by Mr Van Duzee.

Scaphoideus luteolus Van Duzee

Scaphoideus luteolus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 210

This species was described from specimens taken near New York city and Anglesea N. J. It is closely related to immistus and either has been confused with that species or has been so rare as to escape notice.

Scaphoideus lobatus Van Duzee

Scaphoideus lobatus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5. 1894. p. 199

Described from specimen collected at Lancaster, Sep. 8 and has since been collected at Hamburg, Ithaca, Mosholu, Jamaica, Cold Spring Harbor and Poughkeepsie. A well marked species but so far noticed in very small numbers.

Scaphoideus auronitens Prov.

Scaphoideus auronitens Provancher. Pet. Faune Ent. Can. 1889. 3: 277; Van Duzee. Cat.; Am. Ent. Soc. Trans. 21: 301; Osborn & Ball, Ia. Acad. Sci. Proc. 4: 232 (record)
Scaphoideus auronitens Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 199; Osborn, Cin. Soc. Nat. Hist. 19: 194

Recorded for New York by Van Duzee and Osborn, definite records based on specimens in collection at Albany, Lancaster and Albion. I took it at Hamburg and Jamaica. Van Duzee reports it for Phoenicia also and Mr H. G. Barber has sent me a specimen labeled Cold Spring Harbor.

At Hamburg it occurred in numbers on Geranium robertsonium and it seems quite probable that this is its food plant. Larvae occurring on same plants and without much doubt the immature form of this species.

Larva. Head sharply pointed, body fusiform. Length 4.5 mm. Two triangular black spots near apex of vertex. Transverse quadrate spot on vertex, one anterior median, two lateral quadrate spots on pronotum, two on mesothorax, and two small narrow points on metathorax, orange red. Head and prothorax, front of head and metathorax, wing pads white. Abdomen fuscous, white points in series on segments 1–6. 4 and 5 with larger white patch in one specimen (more mature). Seventh segment ivory white above. Below whitish, eyes marked with black dots. Anterior margin of vertex and upper part of front bearing three black lines.

Scaphoideus jucundus Uhler

Scaphoideus jucundus Uhler. Md. Acad. Sci. Trans. 1. 1889. p. 34; Van Duzee, Can. Ent. 1889. 21: 11 (mention); Van Duzee, Am. Ent. Soc. Trans. 21: 300; Osborn, Cin. Soc. Nat. Hist. Jour. 19: 795

A specimen of this handsome species collected at Karner, Aug. 31, 1904 [N.Y. State coll.] Van Duzee mentions it as occurring in the vicinity of Buffalo.

Scaphoideus ochraceus Osb.

Scaphoideus ochraceus Osborn. The Genus Scaphoideus. Cin. Soc. Nat. Sci. Jour. 19: 202.

Reported for Gowanda by Mr E. P. VanDuzee.

Scaphoideus intricatus Uhl.

Scaphoideus intricatus Uhler. Trans. Md. Acad. Sci. 1: 34.

Collected at Albion by Mr E. P. VanDuzee.

Scaphoideus carinatus Osborn

Scaphoideus carinatus Osborn. Cin. Soc. Nat. Hist. Jour. 19: 201

This is a large and well marked species but evidently very rare as it has so far been noted for but three localities. Our New York record is based on a single specimen collected by Mr Van Duzee at Hamburg and one for Cold Spring Harbor [Barber] but it has been taken in New Hampshire and New Jersey and should occur in eastern New York.

Scaphoideus productus Osborn

Cin. Soc. Nat. Hist. Jour. 19: 200

A specimen of this species known hitherto only from Iowa, Kansas and Kentucky has been sent to me by Mr H. G. Barber, collected at "Cold Spring Harbor, July 25, 1900."

Scaphoideus immistus Say

Jassus immistus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 306
Scaphoideus immistus Uhler. Md. Acad. Sci. Trans. 1. 1889. p. 33.
Scaphoideus immistus Southwick. Science, 1892. 19: 288
Scaphoideus immistus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5. 1894. p. 190
Scaphoideus immistus Osborn. Cin. Soc. Nat. Sci. Jour. 19: 204

Collected at Hamburg, Eagle Bridge, Salem, Karner, Cold Spring Harbor and Jamaica. "Found most frequently on witch hazel and other bushes" Van Duzee, July to September. Reported also for Lake Placid, Phoenicia, Kingston and Jamaica by Mr Van Duzee.

This species presents great variability, and many of the variations seem to defy limitation, passing by such insensible grades as to make precise definition impossible.

Scaphoideus opalinus n. sp.

Belongs to immistus group and is possibly a rather extreme variety of that species although it has a broader, more robust appearance and the white is brighter, more milky, translucent. Gray; vertex, scutellum, two broad sutural spots of elytra and three roundish translucent spots bordering claval suture, opalescent white.

Length of female to tip of elytra 5. mm. Length of male to tip of elytra 4.75 mm.

Vertex subangulate about one and one half times as long at middle as next eye. Front narrowed below antennae, clypeus expanding from middle. Lores large, their borders almost touching margin of cheek. Pronotum broad, posterior border concave. Claval veins not very strongly recurved. Reflexed veins two or three, from anterior half of outer ante-apical cell.

Color. Grayish tinted with fulvous. Vertex ivory white crossed by a rather obscure brownish band. Prothorax with ivory white band between hind border of eyes. Scutellum polished ivory white, except outer angles which are black. Sutural border of clavus with broad circular milky or milky opalescent spots separated by a black bar on the slightly recurved claval vein and with a black spot anteriorly and posteriorly, the latter at the end of the clavus. The remainder of the elytra with fuscous, fulvous and milky white patches of general pattern of immistus.

Genitalia. Last ventral segment of female long, posterior borders, rounded, polished, black on apical portion. Male; valve short, rounded; plates short reaching a little more than half the length of pygofer, obliquely truncate, minutely ciliate.

This species was beaten from red cedar at Cold Spring Harbor and appears in some minute particulars to differ so distinctly from the varieties of immistus that it seems best to give it separate description. While there is little difference in genitalia or general color pattern, there is quite a marked difference in the width of the claval spots, angle of the claval vein, and shape of body as a whole. The two circular opalescent spots formed by the semicircles on each clavous present a quite distinctive picture.

Athysanus obsoletus Kirsch

Athysanus obsoletus Kirsch. Die Athysanus Arten v. Wiesb. 1858. p. 7

Athysanus obsoletus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p.199

Reported for Buffalo and Lancaster.

Athysanus venosus n. sp.

Robust, broad, elytra with very conspicuous pallid veins, apical cells nearly obsolete. Length of female to tip of ovipositor, 5 mm.

Vertex elongate, one and one third times as long at middle as at eye with a rather evident elevation paralleling the occiputal margin from front border of eye, vertex rounding uniformly on to front, front broad, full, tapering evenly to the apex which is slightly broader near base, clypeus slightly rounded. Pronotum short, about three times as wide as its length at middle, almost lunate in form, the scutellar margin distinctly concave, elytra short reaching base of sixth dorsal segment, subhyaline, veins very conspicuous, a second cross vein between inner fork of the ulna and the radial, five apical cells, four lying next the subtruncate apical margin much reduced, wings about three fourths length of elytra.

Color. Light brown faintly lined on vertex and mottled on pronotum and scutellum with gray, ocelli red, frontal arcs almost obsolete, the sutural lines of face a little more intense, claval suture brown, elytral veins whitish, a series of points at base of apical spines. The apical portions of tarsi, the tarsal claws, the hind border of the last ventral segment and margin of ovipositor blackish.

Genitalia. Last ventral segment of female twice as long as preceding one, slightly produced into a tooth at the lateral posterior angle and roundingly produced at the middle, pygofers tumid, very scantily ciliate, reaching to tip of ovipositor.

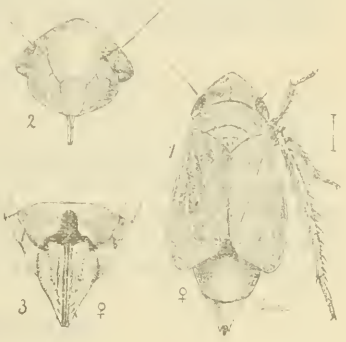


FIG. 22 Athysanus venosus Osb. 1=female dorsal view; 2=face; 3=female genitalia (Drawn by L. H. Joutel)

A single specimen of female collected by Mr E. P. Van Duzee at Lake Placid, Adirondacks. This species may be associated with the extrusus group, being very similar to extrusus in general shape, the vertex somewhat more produced and differing decidedly in the color and markings.

Athysanus extrusus Van Duzee

Athysanus extrusus Van Duzee. Can. Ent. 1893. 25:283
Athysanus extrusus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 199

Reported for Mosholu [American Museum], Adirondacks, Portage Falls [Van Duzee].

Athysanus striola Fall.

Cicada striola Fall. Acta Holm. 1806. 27:31
Athysanus striola Van Duzee. Can. Ent. 1889. 21:11; Cat., p. 303 (Limnotettix)
Athysanus striola Osborn & Ball. Dav. Acad. Nat. Sci. 1898. Proc. 7:91, pl. 5, fig. 4
Limnotettix striola Van Duzee. Buf. Soc. Nat. Sci. Bul. b. 300

Collected at Buffalo and Phoenicia by Van Duzee. A specimen from Karner, Aug. 31, 1904 and I took one at Hamburg, Aug. 8, 1904. Widely distributed in Europe and North America.

Athysanus osborni Van Duzee

Deltocephalus osborni Van Duzee. Am. Ent. Soc. Trans. 1882. 19:309; Buf. Soc. Nat. Sci. Bul. 5, p. 198
Athysanus osborni Osborn & Ball. Ohio Nat. 2:249

Described from Lancaster N. Y. but apparently quite rare.

Athysanus simplarius O. & B.

Deltocephalus simplex Van Duzee. Am. Ent. Soc. Trans. 19: 305; Am. Ent. Soc. Trans. 21: 293
Athysanus simplarius Osborn & Ball. Ohio Nat. 2: 249

The record by Mr Van Duzee is the only one for the State.

Athysanus anthracinus Van Duzee

Athysanus anthracinus Van Duzee. Can. Ent. 1894. 26: 136

This species was described as from Iowa, Kansas and Colorado, Osborn and Ball record in addition District of Columbia, Mr Van Duzee reports it as collected at Lake Placid and I have specimens from Mr H. G. Barber collected at Woods Hole Mass. so it may be added to the New York fauna.

Athysanus plutonius Uhler

Jassus plutonius Uhler. U. S. Geol. & Geog. Sur. Bul. 3. 1877. p. 47
Athysanus plutonius Prov. Pet. Faune Ent. Can. 1889. 3: 282
Athysanus plutonius Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 199

Reported for Hamburg, Buffalo and Lake Placid [Van Duzee, Buf. Hemip. p. 199], Mosholu [Bueno]. A small black or nearly black species usually quite rare. I collected it at Jamaica.

Athysanus striatulus Fallen

Cicada striatula Hem. Suec. 1826. 2: 45
Athysanus instabilis Van Duzee. Can. Ent. 1893. 25: 284
Athysanus striatulus Osborn & Ball. Ohio Nat. 2: 242

"Size and form of preceding species, but darker and lacking tawny tinge, legs dark, femora twice annulate with pale. Length ♀ 4.5 mm, ♂ 4 mm; width, 1 mm."

Closely related to vaccinii and occurring in similar range in this country but also found in Europe. Recorded for New York by Osborn and Ball. One specimen long winged, Cold Spring Harbor.

Athysanus vaccinii Van Duzee

Athysanus striatulus Fall. (?) (or vaccinii nov.) Van Duzee. Am. Ent. 1890. 6: 134
Athysanus striatulus Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 1898. 7: 91, pl. 5, fig. 3.
Athysanus vaccinii Osborn & Ball. Ohio Nat. 2: 242

"Form and size of striatulus, but lighter colored. Smaller and narrower than symphoricarpae, which it approaches in color. Olive testaceous, darker below; the tips of the anterior and middle femora and all of the tibiae, orange. Length ♀ 4.5 mm, ♂ 4 mm; width 1 mm."

A rather common species and records for Karner and Poughkeepsie are based on New York State collection; Lake Placid, specimens from Van Duzee.

Athysanus curtisii Fitch

Athysanus curtisii Fitch. Homop. N. Y. State Cab. 1851. p. 61 reprinted in Lintner. 9th Rep't. 1893. p. 401
Tettigonia curtisii Walker. Homop. 1852. 4: 1159
Deltocephalus curtisii Prov. Pet. Faune Ent. Can. 1889. 3: 278
Athysanus curtisii Van Duzee. Psyche. 1890. 5: 290
Jassus nervatus Prov. Nat. Can. 1872. 4: 378
Athysanus curtisii Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 199

Records from Buffalo, Otto, New York city, Ithaca, Karner, Nassau, Clinton Heights, Warwick, Lake Placid, Kingston, Phoenicia, Staten Island.

I took it at Hamburg, Nassau, Eagle Bridge, Salem, Cold Spring Harbor and Jamaica.

A very common species specially in or near woodland where it thrives on grasses. The Fitch types are in fair condition and leave no question as to the species.

Genus DRIATURA Osborn & Ball

Driatura gammaroidea Van Duzee

Athysanus gammaroidea Van Duzee. Buf. Soc. Nat. Sci. Bul 1894. 5: 209
Driatura gammaroidea Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 7: 89.

Taken at Cold Spring Harbor, Hamburg [O.], Jamaica and Mosholu [Bueno].

Originally described from Kansas. This species has not till recently been recognized from this State.

It is a small blackish insect with wide vertex, short elytra and extended ovipositor.

GENUS ATHYSANELLA Bak.

Athysanella acuticauda Baker

Psyche, 8: 187.

Reported for Lake Placid by Mr Van Duzee.

GENUS GONIOGNATHUS

Goniagnathus palmeri Van Duzee

Goniagnathus palmeri Van Duzee. Can. Ent. 1891. 23: 171

Specimens from Forest Park, L. I. collected by Mr J. R. de la Torre Bueno.

Described from North Carolina, distribution South. I have specimens from Greensburg Pa. collected by Rev. Modesto Wirtner.

Genus EUTETTIX Van Duzee

Eutettix seminuda Say

Jassus seminudus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 307, reprinted in Compl. Wr. 1869. 2: 383
Bythoscopus seminudus Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398

Thamnotettix seminudus Uhler. Stand. Nat. Hist. 1884. 2: 246
Athysanus seminudus Van Duzee. Psyche. 1890. 5: 389
Eutettix seminudus Van Duzee.. Psyche. 1892. 6: 307
Eutettix seminudus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 191

I have seen specimens in collections for Hamburg, Ithaca, Albany, Nassau and New York city. It has been reported for eastern New York, Lancaster, Buffalo [Van Duzee, Buf. Hemip. p. 199] and I took it at Eagle Bridge, Salem, Cold Spring Harbor and Staten Island.

Eutettix cincta Osborn & Ball

Eutettix cincta Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 1898. 7:97
Eutettix jucundus Van Duzee. Psyche. 1890. 6: 307

A specimen of this species collected at Jamaica, Long Island by Mr Van Duzee. It has hitherto been recorded for Iowa, Texas and Washington D. C.

Eutettix lurida Van Duzee

Thamnotettix lurida Van Duzee. Can. Ent. 22: 250
Eutettix lurida Van Duzee. Psyche. 6: 307

Two specimens from Karner in the New York State collection. The species is probably rare or restricted to some particular food plant of restricted distribution.

Eutettix brunneus n. sp.

Approaching lurida in general pattern but with elytra more hyaline, head and pronotum darker and sutural spot less evident. Length female 6 mm, male 5 mm.

Vertex rounded in front, scarcely longer at middle, transverse furrows very indistinct, front narrowing rapidly to clypeus, clypeus long widening to tip, apex subtruncate, lores large, wider than

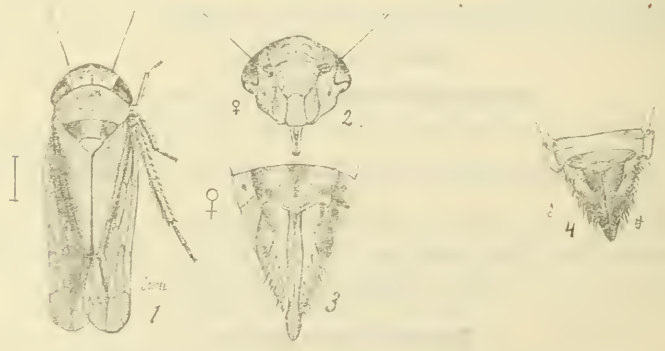


FIG. 2 Eutettix brunneus Osb. 1=female dorsal view; 2=face; 3=female genitalia; 4=male genitalia (Drawn by Joutel)

clypeus, pronotum about two and one half times as wide as length at middle, posterior border slightly concave. Elytra long, rather narrow distinctly flaring toward apex.

Color. Brown, vertex with lighter patches on occiput and interior margin. Front with about seven faint arcs, obsolete towards the center, sutural margins reddish, elytra subhyaline, tinged with yellowish brown infuscated toward the apex. A faint grayish spot on the sutual margins of posterior half of clavus. Legs with fine blackish lines, black dots at bases of spines.

Genitalia. Last ventral segment of female moderately long, simple, posterior border very faintly toothed at lateral angles and at middle. Dentated lateral margin and bidentated middle toothed. Male, valve short, broad, rounded behind, plates narrowing evenly to an acute apex, the margin rather densely ciliate.

Two specimens male and female from Mr E. P. Van Duzee, the former labeled Gowanda, Aug. 18, 1898, also one specimen, female apparently of the same species but with abdomen lost, labeled Karner, N. Y. from Dr E P. Felt.

Eutettix strobi Fitch

Bythoscopus strobi Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398; N. Y. State Agric. Soc. Trans. 1857. 17: 739
Phlepsius strobi Van Duzee. Ent. Soc. Trans. 21: 249
Collected in eastern New York, [Fitch] Buffalo, [Van Duzee].

This species has suffered many generic changes due to its possessing in some degree characters relating it to many groups. While it shows some faint ramose lines on elytra, the character of the vertex and its general facies seem to place it more properly with the species included under Eutettix.

In Fitch's type the head is subangular, longer on middle than next the eye, narrower than pronotum, the transverse depression on vertex scarcely visible, no trace of irrorations on the elytra, the last ventral segment simple, very slightly convex, about twice as long as preceding.

Eutettix southwicki Van Duzee

Eutettix southwicki Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 209

Original description was from two male specimens taken near New York city by Mr Southwick.

A type specimen is in the Iowa State College and another in the Cornell University collection.

Eutettix johnsoni Van Duzee

Eutettix johnsoni Van Duzee. Can. Ent. 1894. 26: 137

This is a rather rare species originally described from the vicinity of New York and Philadelphia. I have seen specimens from Mosholu [Bueno]—June 28, 1902, and took it at Staten Island and Jamaica the past summer. It is fully described by Mr Van Duzee.

GENUS PHLEPSIUS Fieb.

Phlepsius humidus Van Duzee

Phlepsius humidus Van Duzee. Am. Ent. Soc. Trans. 19: 76; Southwick, Science. 1892. 19: 288
Paraphlepsius ramosus Baker. Can. Ent.

The type of the species is from Buffalo and it has been collected also near New York city and at Phoenicia. It is a broad species, the margin of the head acute so that it bears some resemblance to the Acocephalids but in all other characters it is closely associated with the Phlepsids.

It is found in low ground and may be swept from rank growth along streams. According to Mr Van Duzee its host plants are Sagittaria and Polygonum.

Phlepsius nebulosus Van Duzee

Phlepsius nebulosus Van Duzee. Am. Ent. Soc. Trans. 1892 19: 78

One specimen of female of this large and interesting species has been received from Harry G. Barber collected at "Cold Spring Harbor, L. I." Van Duzee gave its distribution as Dakota, Iowa (?), Mississippi and Florida. I have a specimen from Nebraska and males from Angelsea N. J., and Durham N. H. so it appears to be quite widely distributed.

Phlepsius apertus Van Duzee

Phlepsius apertus Van Duzee. Am. Ent. Soc. Trans. 1892. 19: 76

Originally described from Canada. This species has been taken at Keene Valley, July 1898, [Felt] and Lake Placid [Van Duzee].

Phlepsius fuscipennis Van Duzee

Phlepsius fuscipennis Van Duzee. Am. Ent. Soc. Trans. 1892. 19: 70, pl. 1, fig. 2; Southwick, Science. 1892. 19: 287

Van Duzee cites "New York" as habitat for the species. I have seen specimens from Albany in the New York State Museum from Mr Bueno. Mr Southwick has also reported it.

Phlepsius fulvidorsum Fitch.

Jassus fulvidorsum Fitch. Homop. N. Y. State Cab. 1851. p.62. reprinted in Lintner. 9th Rep't. 1893. p. 402
Phlepsius fulvidorsum Van Duzee. Psyche. 1890. 5: 390; Am. Ent. Soc. Trans. 1892. 19: 74, pl. 1, fig. 10; Southwick, Science, 1892. 19: 287; Van Duzee, in Lintner. 9th Rep't 1893. p. 410; Van Duzee, Buf. Hemip. p. 199

While the types of this species are too much changed for satisfactory comparison there is no doubt as to the correctness of Mr Van Duzee's reference and his full redescription furnishes a good basis for the identification of the species. The pronounced fulvous color of head, pronotum, and scutellum mark it off at once from other species.

Aside from Fitch's original locality, probably Salem, it has been recorded from Buffalo and vicinity, Colden, Lake Placid and Lancaster by Mr Van Duzee. His record that it occurs " always on hemlock, spruce or pines " seems to be supported by later collections.

Phlepsius incisus Van Duzee

Phlepsius incisus Van Duzee. Am. Ent. Soc. Trans. 1892. 19: 73; Buf. Soc. Nat. Hist. Bul. p. 199

Specimens noted for Gowanda in addition to Buffalo and Lancaster. Previously recorded by Mr Van Duzee, also collected by him at Lake Placid in 1904.

Phlepsius irroratus Say

Jassus irroratus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 308; reprinted in Compl. Wr. 1869. 2: 1384; Fitch, Homop. N. Y. State Cab. 1851. p. 62; reprinted in Lintner. 9th Rep't. 1893. p. 402; N. Y. Agri. Soc. Trans. 856. 16: 449; Lintner. 1st Rep't. 1882, 133, (notice)

Allygus irroratus Uhler. Stand. Nat. Hist. 1884. 2: 245, fig 310

Phlepsius irroratus Van Duzee. Am. Ent. 1890. 6: 93; Psyche. 1890. 9: 389; Am. Ent. Soc. Trans. 1892. 19: 71, pl. 1, fig. 6, 7, 21; Van Duzee, in Lintner. 9th Rep't. 1893. p. 410

Buffalo [Van Duzee], New York city [Bueno], Salem, Nassau, Cold Spring Harbor, Staten Island, Jamaica.

Abundant everywhere that collections have been made. Occurs on a wide range of plants and in a wide range of conditions.

Phlepsius majestus Osborn & Ball

A specimen of this interesting species has been received from Mr J. R. De La Torre Bueno, collected at Mosholu N. Y. Heretofore the species has been recognized from New Jersey, Iowa, and Ohio. It is very rare in collections due probably to the fact that it is extremely active and difficult to capture, often escaping from the net into which it may have been swept. It occurs on wet land being swept from the low vegetation but the particular food plant if it has a single host has not been determined. It is the largest and one of the most handsome species of the genus.

Phlepsius decorus Osborn & Ball

Phlepsius decorus Osborn & Ball. Ia. Acad. Sci. Proc. 1894. 4: 230

Evidently a rare specimen in the State as it has been collected only at Hamburg by Mr Van Duzee. It has been taken at Brockville Ont. by Mr Metcalfe, Aug. 23, 1903.

It occurs in moist locations and probably feeds on some of the coarse grasses but the particular species has not been determined.

Phlepsius excultus Uhler

Jassus excultus Uhler. U. S. Geol. & Geog. Sur. Bul. 3. 1877. p. 467
Phlepsius excultus Van Duzee. Am. Ent. Soc. Trans. 1892. 19: 80, pl. 1, fig. 17

This species is included in the New York list on the authority of Mr Uhler. It has not come to light in any recent collections in the State that I have seen.

Thamnotettix kennicotii Uhl.

Thamnotettix kennicottii Uhl. Am. Ent. Soc. Proc. 1863. 2: 161
Thamnotettix kennicottii Uhler. Stand. Nat. Hist. 1884. 2: 246; Osborn, Ia. Acad. Su. Proc. 1, 1892. pt 2, p. 12; Van Duzee, Psyche. 1892. 6: 306

Reported for Buffalo Plains and Hamburg "on oak and hickory bushes" [Van Duzee, Buf. Hem: p. 200], also for 1904 from Lake Placid.

Thamnotettix belli (Uhl.)

Jassus belli Uhler. U. S. Geol. & Geog. Sur. Bul. 1877. 3: 471
Thamnotettix belli Van Duzee. Psyche, 6: 306

A single specimen in the New York State collection at Albany is referred here, though the genitalia do not agree well with Uhler's description.

Thamnotettix eburata Van Duzee

Thamnotettix eburata Van Duzee. Can. Ent. 1889. 21: 10 Am. Ent. Soc. Trans. 21: 301

Evidently rare and having its distribution northward.

Thamnotettix clitellarius (Say)

Jassus clitellarius Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 309; reprinted in Compl. Wr. 1869. 2: 384; Walker Homop. 1852. 4: 1164 (mention); Harris, Hitchcock Geol. of Mass. 1835. ed 2, p. 580; Smith, Cat. Ins. N. J. 1890. p. 446
Thamnotettix clitellarius Van Duzee. Psyche. 1893. 6: 306 (notice); in Lintner. 9th Rep't. 1893. p. 410

This has been very generally recognized over the country owing to its conspicuous appearance as well as its common occurrence on a variety of plants. New York collections have been noted for Albany, Highland, Clinton Heights, Poughkeepsie, Lake Placid, Phoenicia, Mosholu, Forest Park. I collected at it Hamburg, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica and Staten Island the past summer.

Thamnotettix exquisitos n. sp.

Resembles clitellarius but is larger, the vertex distinctly angular, the sutural spot long and narrow, the frontal spots larger, closer together. A black spot at the base of antennae, the color

blackish, the female genital segment with broad triangular excavation within which the ligulate process shorter, not longer than segment. Length ♀ 6mm, ♂ 5.5mm.

Head broad, vertex about one and one half times as long at middle as at eye; subangulate, front narrowing evenly to clypeus, clypeus rounding at apex. Lores elongate, cheek rather broadly rounded at the sides, pronotum rather strongly arcuate in front, truncate behind.

Color. A deep fuscous black, vertex except at base, posterior part of pronotum, elongate spot on elytra, bright lemon yellow; costal half of elytra light yellowish, transparent, terminating abruptly and squarely near the apex; face and beneath light yellow; two conspicuous oval black spots just below the vertex almost meeting at the apex of the vertex. Small spot at base of antennae black.

Genitalia. Last ventral segment of female broad, with deep triangular excavation including a short ligulate process not reaching the hind border of the segment. Pygofers with rather coarse bristles, ovipositor reaching tip of pygofer and of the same color. Male valve small, plates elongate, triangular, acuminate, reaching beyond pygofer, the border ciliate.

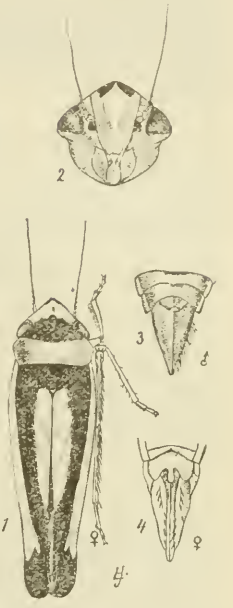


FIG. 24 Thamnotettix exquisitos Osb. 1=Female dorsal view; 2=face; 3=male genitalia; 4=female genitalia. (Drawn by L. H. Joutel)

A number of specimens were collected in a deep wood in a boggy swamp in Hamburg N. Y. by Mr E. P. Van Duzee and myself. They occurred on underbrush but the particular food plant, if they are confined to a single species was not determined. The species has such a striking resemblence superficially to clitellarius that it is perhaps not strange that its distinctness has been overlooked. Moreover, it is very rare in collections and perhaps its occurrence in deep wood is responsible for this.

Three specimens of this species were observed also in Cornell University collection associated with clitellarius and a single specimen has stood for some years in the O. S. U. collection having been collected at Ithaca N. Y., by Mr J. S. Hine, This specimen bearing the determination of clitellarius by Mr Van Duzee.

The species may be at once separated by the genital character and furthermore by constant difference in shape of vertex, position of spots under vertex, shape of sutural spot and transparent costal area and blacker color.

The known distribution so far has been limited to the two points mentioned—Hamburg and Ithaca N.Y.

Thamnotettix fitchi Van Duzee

Thamnotettix fitchi Van Duzee. Am. Ent. 1890. 6:133
Cicadula 4-punctata Fitch, M. Insect Life. 1894. 6:267
Thamnotettix fitchi Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 200

Recorded for Buffalo [Van Duzee, Buf. Hemip. p. 200], Lancaster, Hamburg, Colden, New York. Specimens are in collections for Albion, Phoenicia and Staten Island. I collected it at Cold Spring Harbor. This is fully characterized by Mr Van Duzee in the original description. It is sometimes quite common but I have never known it swarm in such abundance as some of the species.

Thamnotettix decipiens Prov.

Thamnotettix decipiens Prov. Pet. Faune Ent. Can. 1890 3: 285.

Collected by Mr Van Duzee at Lake Placid.

Thamnotettix inornata Van Duzee

Thamnotettix inornata Van Duzee. Am. Ent. Soc. Trans. 1892. 19: 303
Thamnotettix inornata Buf. Soc. Nat. Sci. Bul. 5, p. 300

Aside from the type locality, Lancaster, Mr Van Duzee has taken this at Lake Placid and I took it at Salem.

Thamnotettix placidus n. sp.

Somewhat similar to inornata but distinctly more yellowish and with different genitalia. Length of female 5 mm.

Vertex rounded in front about one fourth longer at middle than at eye, front with lateral margins evenly curved, clypeus widening slightly toward tip, scarcely truncate, lores barely reaching margin of cheek, pronotum broadly rounded in front emarginate behind, elytra hyaline.

Color a rather deep straw yellow, a little more intense on the vertex and face and tip of pygofers, tip of ovipositors tinged with fulvus, margins of the abdominal segments tinged with fulvus, margins of the abdominal segments, sometimes most of the tergum blackish, tip of beak and a series of median and ventral spots black.

Last ventral segment of female emarginate, median border faintly striated, pygofers elongate reaching almost to tip of ovipositor with stiff setae, those toward tip stronger and tinged with fulvus.

Six specimens collected at Lake Placid by Mr E. P. Van Duzee. It differs from fitchii in the absence of any spots on the margin of the vertex and in the presence of black spots underneath and in the general color which, while hard to describe, is very evident in associated specimens. The shape of the genital segment is also different.

Thamnotettix infuscata Gill. & Bak.

Thamnotettix infuscata Gill & Bak. Hemip. Colo. p. 98.
Thamnotettix punctiscuta Gill & Bak. Hemip. Colo. p. 99.

Resembles Athysanus obsoletus in general shape but with a more produced vertex and very long elytra and wings, these extending considerably beyond end of abdomen. Length of female 5.5 mm.

Vertex produced, angulate in front, one and one half to one and three fourths times as long at middle as at eyes, margin rounded over to front. Front broad, nearly as wide at antennae as its length, broader at apex than at base of clypeus, clypeus narrowing slightly at apex, apex broadly rounded, lores ovoidal, not reaching border of genae, pronotum semicircular in front, slightly concave behind, elytra with conspicuous nervures, one cross vein between the fork of the radial and ulnar veins, apical cells well developed, very narrow appendix.

Color. Greenish olivaceous to brownish. The vertex, anterior border of pronotum, scutellum, and costal border of elytra mostly greenish yellow, posterior portion of pronotum and elytra except costal margin a rather translucent greenish gray, the elytra in some specimens deeply infuscated. Front yellowish gray with faint arcs, the sutural lines infuscated, those between the apical portion of the lores and clypeus sometimes broadening slightly to a fairly distinct spot, thorax and end of abdomen below mostly black, yellow margins, the legs greenish with fuscous points and tarsal claws, all the colors more intense in the male.

Genitalia. Last ventral segment of female moderately long, polished, truncate at apex, slightly, produced at lateral angles and faintly notched at middle, pygofers extending almost to tip of ovipositor, scantily clothed with short setae. Male, last ventral segment with yellowish border, the valve short, obtuse, angulate behind, blackish, the plates angulate narrowing gradually to an obtusely rounded tip.

Three specimens of this species collected by Mr E. P. Van Duzee at Lake Placid in the Adirondacks. I have also a specimen from Sault Ste. Marie collected by Mr H. M. Parish.

While very distant from the locality where this species was originally described the fact of its occurrence in the mountain region and the intermediate locality of Sault Ste. Marie indicates that it has a rather wide distribution in boreal regions. It was thought to be undescribed but there seems little doubt that it belongs to this species.

Thamnotettix melanogaster Prov.

Jassus melanogaster Prov. Nat. Can. 1872. 4:378
Thamnotettix melanogaster Prov. Pet. Faune Ent. Can. 1890. 3: 284
Thamnotettix melanogaster Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 200

Occurs in low damp places on coarse grass or sedges. Hamburg.

Thamnotettix cyperaceus Osb.

Thamnotettix cyperaceus Osb. Ia. Acad. Sci. Proc. 5: 246

Collected at Hamburg by Mr Van Duzee, Aug. 8, 1904, the first instance of its occurrence east of its original locality in Iowa.

Genus CHLOROTETTIX Van Duzee

Chlorotettix unicolor Fitch

Bythoscopus unicolor Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398; Walker, Homop. 1852. 4: 1161
Athysanus unicolor Southwick. Science. 1892. 19: 288
Chlorotettix unicolor Van Duzee. Psyche. 1892. 6: 306, 308. Lintner. 9th Rep't. 1893. p. 410
Chlorotettix unicolor Van Duzee. Buf. Hemip. p. 200

Specimens from Albany, Saranac Inn, Lake Placid, Keene Valley, Essex county, Phoenica, Cold Spring Harbor, Oyster Bay, Eagle Bridge, Salem, Jamaica, Staten Island; Mosholu [American Museum]. Probably described from specimen collected at Salem. Buffalo, June to August [Van Duzee, Buf. Hemip. p. 200.]

Chlorotettix tergata Fitch

Bythoscopus tergatus Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398; Walker, Homop. 1852. 4: 1161, (mention)
Athysanus tergatus Southwick. Science. 1892. 19: 288
Chlorotettix tergatus Van Duzee. Psyche. 1892. 6: 306, 309; Lintner. 9th Rep't. 1893. p. 410

Described from specimens probably collected at Salem and since recorded for Buffalo [Van Duzee, Buf. Hemip. p. 200] and New York city. I took it at Hamburg, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica, Staten Island and have seen specimens in collections from Nassau, Karner, and Mosholu. It is a widely distributed species easily known by the smoky color with evenly rounded vertex.

Chlorotettix viridia Van Duzee

Chlorotettix viridia Van Duzee. Psyche. 1892. 6: 309; Weed, Can. Ent. 1892. 24: 278.
Athysanus viridius Southwick. Science. 1892. 19: 288

Mr Van Duzee reports it for Lake Placid, Jamaica and Staten Island and I collected two specimens at Jamaica, Aug 20 and Mr H. G. Barber sends me a specimen from Cold Spring Harbor.

Chlorotettix galbanata Van Duzee

Chlorotettix galbanata Van Duzee. Psyche. 1892. 6: 310
Athysanus galbanatus Southwick. Science. 1892. 19: 288

Occurs in southern part of the State, in vicinity of New York city. It is more abundant to south and west, I secured specimens at Salem and Nassau, and Mr Van Duzee reports collecting it at Jamaica and Staten Island.

Chlorotettix balli Osborn

Chlorotettix balli Osborn. Ia. Acad. Sci. Proc. 5: 247

One specimen collected at Jamaica, Aug. 20. This species was described from Iowa and this is the first record east of the Alleghanies.

Chlorotettix lusoria Osborn & Ball

Thamnotettix lusoria Osborn & Ball. Ia. Acad. Sci. Proc. 1896. 4: 226

This species resembles tergatus in color but is at once separated from that species by the more pointed head.

It appears to be rare in New York, only three instances of its occurrence, Lake Placid, Phoenicia, [Van Duzee] and Poughkeepsie, having come to my notice. Specimens in the Van Duzee collection and the State Museum.

Jassus olitorius Say

Jassus olitorius Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 310
Coelidia olitaria Fitch. Homop. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398
Jassus (*sens. strict.*) olitorius Van Duzee. Psyche. 1890. 5: 389; reprinted in Lintner. 9th Rep't. 1893. p. 410
Jassus subbifasciatus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 310
Coelidia subbifasciata Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398
Jassus subfasciatus Southwick. Science. 1892. 19: 288
Jassus olitorius Say. Van Duzee. Buf. Soc. Nat. Sci. Bul. 5: 200

Reported for Karner, Staten Island, Aug. 15; Mosholu, Sep. 14, 1902 [Bueno]; Buffalo and Phoenica [Van Duzee]. Fitch records it for beech and raspberry. This is an abundant species found on various bushes and shrubs. I took it at Hamburg, Salem, Cold Spring Harbor and Jamaica.

Paracoelidia tuberculata Baker

Paracoelidia tuberculata Baker. Can. Ent. 1898. 30: 292

I took a number of specimens by beating small pinetrees on the "barrens" near Oyster Bay.

The species is readily recognized by the prominence of the clypeus. Pine is evidently the host plant as I have never met it on other vegetation and Baker in his description states that the specimens from Baltimore [Uhler's] were taken on pine.

Cicadula 6-notata Fall.[1]

Cicada 6--notata Fallen. Acta Holm. 1806. 27: 34
Cicadula 6-notata Southwick. Science. 1892. 19: 288

This species common to Europe and North America has been noted for New York city, Karner, Poughkeepsie, Big Moose, Keene

[1] For full bibliography and synonomy consult Van Duzee's Catalogue, Jassoidea, North America, Am. Ent. Soc. Trans. 16: 307

Valley [N.Y. State col.] Lake Placid, Phoenicia, Kingston [Van Duzee] and I collected it at Hamburg, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica and Nassau.

It is unquestionably a species of economic importance as it often swarms in grass land. It seems to favor the annual grasses rather than the perennials.

Cicadula slossoni Van Duzee

Cicadula slossoni Van Duzee, Can. Ent. 1893. 25:281; Buf. Soc. Nat. Sci. Bul. 5, p. 200

Evidently a rare species as Van Duzee says "a single example of this pretty little species was taken by me at Lancaster, July 12, 1889." He reports taking it in August 1904 at Lake Placid and Phoenicia.

Cicadula variata Fall.

Cicada variata Fall. Acta Holm. 1806. 27:34
Jassus variatus H. Sch. Nom. Ent. 1835. p. 70
Limotettix variata Sahlbg. Cicad. 1871. p. 250
Cicadula variata Fieb. Revue d. Ent. 1885. 4:51; Van Duzee, Psyche. 1892. 6:305
Cicadula variata Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 200

Reported for Lancaster. June to September [Van Duzee].

While by no means so abundant as 6-notata this species has a wide distribution and may doubtless be found in all parts of the State. I took it at Nassau in August and Mr Van Duzee at Lake Placid during the same month, also at Phoenicia.

Cicadula punctifrons var. americana Van Duzee

Cicadula punctifrons var. americana Van Duzee. Can. Ent. 1891. 23:169; Buf. Soc. Nat. Sci. Bul. 5, p. 201

Recorded for Buffalo [Van Duzee], and specimens from "Keene Valley", "Essex Co.," are in the N.Y. State collection.

It occurs in abundance on low scrubby willows, usually most common on sandy margins of streams.

Cicadula punctifrons Fall.

Cicada punctifrons Fall. Hemip. Suec. Cicad. 1826. p. 42
Thamnotettix punctifrons Boh. K. Vet.—Akad. Handl. 1847
Jassus punctifrons Flor. Rhyng. Livl. 1861. p. 328
Cicadula punctifrons Fieb. Revue d. Ent. 1885. 4:50. (For full synonomy *see* Van Duzee Catalogue.)

Represented for Ithaca [Cornell Coll.], Lancaster [Van Duzee, Buf. Hemip. p. 201]; one example [Van Duzee]

Apparently much less common than the variety listed below.

Cicadula lepida Van Duzee

Can. Ent. 1894. 26:139

Described in part from a specimen collected in New York city.

Cicadula macgillivrayi Baker

Collected at Hamburg N. Y. by Mr E.P. Van Duzee.

Gnathodus punctatus Thunb.

Cicada punctata Thunb. Act. Ups. 1782. 6:21
Jassus punctatus Walk. Homop. 3:877
Gnathodus punctatus Fieb. Verh. Zool. Bot. Ges. in Wien. 16:505
Typhlocyba punctata, Prov. Pet. Faune Ent Can. 1890. 3:301
Typhlocyba vernalis Fitch, M. (*vide* Van Duzee)
Gnathodus punctatus Van Duzee, Am. Ent. Soc. Trans. 21:307

This abundant species has been taken at a number of points in the State; Ithaca [Cornell Univ.], Albany and Poughkeepsie [N.Y. State coll.]. I collected it at Hamburg and Jamaica in August and Mr Van Duzee reports it from Lake Placid, Phoenicia and Kingston.

Gnathodus impictus Van Duzee

Can. Ent. 1892. 24:113; Am. Ent. Soc. Trans. 21:307

Credited to New York in Van Duzee's Catalogue.

Gnathodus viridis n. sp.

Green, broader than punctatus; head less produced, not spotted. Length ♀ 4 mm.

Head slightly narrower than pronotum, slightly subangulate, rounded in front, scarcely longer at middle than at eye. Front broad, short; clypeus long slightly tumid. Pronotum wide, much rounded in front, hind border concave, elytra nearly hyaline.

Color green, elytra greenish, hyaline becoming transparent toward apex. Eyes, antennae, apex of beak, and tarsal claws touched with fuscous.

Female segment rather long, simple, truncate; pygofers with few bristles, ovipositor passing pygofer.

One specimen from Mr E. P. Van Duzee collected at Lake Placid, N.Y. "Summit." The clear green color and shape of pronotum are quite characteristic in this species.

Family TYPHLOCYBIDAE

Genus ALEBRA

Alebra albostriella Fallen

Cicada albostriella Fallen. Hemip. Suec. Cicad. 1829. p. 54
Typhlocyba albostriella Flor. Rhynch. Livl. 1861. p. 373, 382
Alebra albostriella Fieber. Kat. d. eur. Cicad. 1872. p.14
Typhlocyba aurata pallida, and binotata Walsh. Bost. Soc. Nat. Hist. Proc. 1864. p. 315
Alebra aurea, pallida, and binotata Woodworth. Psyche. 1889. 5:213
Erythroneura mali Provancher. Pet. Faune Ent. Can. 1890. 3:298
Alebra aurea Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 201

Taken at Hamburg by Mr Van Duzee, who also reports taking the variety fulveola at Phoenicia, Kingston and Jamaica in August 1904.

Alebra fumida Gillette

Alebra fumida Gillette. U. S. Nat. Mus. Proc. 20: 714

Described from specimens taken at Ithaca.

Genus DICRANEURA

Dicraneura cruentata Gillette

Dicraneura cruentata Gillette. U. S. Nat. Mus. Proc. 20: 717

Recorded for Ithaca by Gillette.

Dicraneura communis Gillette

Dicraneura communis Gillette. U. S. Nat. Mus. Proc. 20: 718

Credited to Ithaca in Gillette's paper on the group, also collected at Lake Placid and Phoenicia by Mr Van Duzee.

Dicraneura Fieberi Löw.

Dicraneura fieberi Melichar. Cicadinen von Mittel-europa. 1896. p. 325

Recorded for Ithaca, July 25 and Aug. 28.

Dicraneura flavipennis Fabr.

Collected at Hamburg N. Y. by Mr E. P. Van Duzee.

Genus EMPOASCA

Empoasca obtusa Walsh

Reported for Phoenicia and Kingston by Mr E. P. Van Duzee.

Empoasca smaragdula Fallen

Cicada smaragdula Fallen. Hemip. Suec. Cicad. 1829. p.53
Typhlocyba smaragdula Flor. Rhynch. Livl. 1861. 2: 393.
Kybos smaragdulus Fieber. Verh. Zool. Bot. Ges. in Wien. 1866. 16: 508
Empoasca smaragdula Gillette & Baker. Colo. Agric. Exp. Sta. Bul. 31. 1895. p. 110

A common species throughout the State. I secured specimens at Hamburg and Salem.

Empoasca trifasciata Gillette

Empoasca trifasciata Gillette. U. S. Nat. Mus. Proc. 20: 726

Gowanda collected by Mr E. P. Van Duzee.

Empoasca atrolabes Gill.

U. S. Nat. Mus. Proc. 20:736

Mr Van Duzee reports collecting this species at Lake Placid.

Empoasca mali Le Baron

Tettigonia mali Le Baron. Prairie Farmer. 1853. 13:330
Empoasca mali Osborn. Ia. Acad. Sci. Proc. 1892. 2:12
Typhlocyba photophila Berg. Hemip. Argent. 1879. p. 273
Empoa albopicta Forbes. Ill. State Ent. Rep't 13. 1883. p. 181, pl. 14
Empoa scaalbopicta Woodworth. Psyche. 1889. 5:213; Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 201

A very abundant and destructive species over a large part of the United States. Recorded for vicinity of Buffalo.

Empoasca flavescens Fabricius

Cicada flavescens Fabricius. Ent. Syst., IV., Hafn., 1794
Chlorita flavescens Fieber. Kat. d eur. Cicad. 1872. p. 14
Empoasca flavescens Gillette. U. S. Nat. Mus. Proc. 20:745

Recorded for Ithaca and Mr Van Duzee reports it for Lake Placid.

Empoasca flavescens var. birdii Goding

Empoasca birdii Goding. Ent. News. 1. 1890. p. 123

Reported for Albany [N. Y. State coll.], also recorded for Ithaca [Gillette].

Empoasca alboneura Gill

U. S. Nat. Mus. Proc. 20:743

Reported for Jamaica by Mr E. P. Van Duzee.

Empoasca viridescens Walsh

Empoasca viridescens Walsh. Bost. Soc. Nat. Hist. Proc. 1864. 9:316
Empoasca consobrina Walsh. Bost. Soc. Nat. Hist. Proc. 1864. 9:316.
Empoasca viridescens Gillette. U. S. Nat. Mus. Proc. 15:747

Gillette records it for Ithaca. Van Duzee reports it for Phoenicia and Staten Island.

Genus EUPTERYX

Eupteryx vanduzei Gillette

Eupteryx vanduzei Gillette. U. S. Nat. Mus. Proc. 20:748

Described from specimens collected by Mr E. P. Van Duzee at Hamburg, who also collected it at Lake Placid.

Eupteryx nigra n. sp.

Above black except anterior portion of vertex and costal margin of elytra; below greenish white except pygofers which are smoky black. Length ♀ 3.75 mm.

Vertex produced, broadly subangulate, about half as long as pronotum; front moderately narrow, full, tapering to base of

clypeus; clypeus with sides nearly parallel narrowing at apex, about one and one third times as long as broad. Pronotum very convex in front, hind border truncate, costal apical cell very deep, extending half way across the elytron, central apical cell pedunculate, first sector evident on discal portion of elytron.

Color. Front part of vertex, all of face, thorax, legs and venter including last ventral segment of female greenish white. Costal border of elytra milky white, toward apex tinged with greenish. Posterior two thirds of vertex suffused with smoky brown, pronotum dead black, scutellum and all of elytra, except costal border, dark smoky brown or blackish, in one specimen showing faint lighter areas in apical portions of clavus and in apical cells.

Genitalia. Last ventral segment of ♀ broad, long, with hind borders evenly rounded, slightly tinged with yellowish; pygofers smoky black like the terga of abdominal segments, with a few marginal whitish cilia.

A specimen from Jamaica collected Aug. 20, 1904. I have also one specimen collected at Columbus O. Sep. 15, 1903.

Eupteryx flavoscuta Gillette

Eupteryx flavoscuta Gillette. U. S. Nat. Mus. Proc. 20: 749

Collected at Hamburg with the preceding, and also at Lake Placid and Phoenicia.

Genus TYPHLOCYBA

Typhlocyba coccinea Fitch

Empoa coccinea Fitch. Homop. N. Y. State Cab. 1851. p. 63; reprinted in Lintner. 9th Rep't. 1893. p. 403
Typhlocyba coccinea Woodworth. Psyche. 1889. 5: 213

Dr Fitch described this as taken from pines.

Typhlocyba tricincta Fitch

Erythroneura tricincta Fitch. Homop. N. Y. State Cab 1851. 9: 63; N. Y. State Agric. Soc. Trans. 1856. 16: 392, 436. reprinted in Lintner. 9th Rep't. 1893. p. 403
Typhlocyba tricincta Woodworth. Psyche. 1889. 5: 213

A common species occurring on a variety of plants. Fitch credited it to currant and raspberry, others have taken it on grape, elm etc.

Typhlocyba trifasciata Say

Tettigonia trifasciata Say. Acad. Nat. Sci. Phil. Jour. 1825; 4: 343
Typhlocyba trifasciata Woodworth. Psyche. 1889. 5: 213

Common everywhere on grape.

Typhlocyba tenerrima H. S.

Gillette. Nat. Mus. Proc. 20: 770

One specimen of this species has been sent to me by Mr E. P. Van Duzee who collected it at Lake Placid in the Adirondacks.

Typhlocyba obliqua Say

Tettigonia obliqua Say. Acad. Nat. Sci. Phila. Jour. 1825 4: 342
Erythroneura obliqua Fitch. Homop. N. Y. State Cab. 1851. p. 63; N. Y. State Agric. Soc. Trans. 1856. 16: 435; reprinted in Lintner. 9th Rep't. 1893. p. 403
Typhlocyba obliqua Woodworth. Psyche. 1889. 5: 213

Another widely distributed species occurring on grape or other plants.

Typhlocyba comes Say

Tettigonia comes Say. Acad. Nat. Sci. Phila. Jour. 1825. 4: 343; reprinted in Compl. Wr. 1891. 2: 259.
Typhlocyba comes Woodworth. Psyche. 1889. 5: 213.
Erythroneura vitifex Fitch. N. Y. State Agric. Soc. Trans. 1856. 16: 392.
Typhlocyba vitifex Woodworth. Psyche. 1889, 5: 213.

Everywhere common on grape and occurring also in a large number of varieties the following being well marked and noted for New York, basilaris, vitis, and the typical form vitifex of Fitch, ziczac Walsh, rubra Gill, and 8-natata Walsh.

Typhlocyba vulnerata Fitch

Erythroneura vulnerata Fitch. Homop. N. Y. State Cab. 1851. p. 62; N. Y. State Agric. Soc. Trans. 1856. 16: 393; reprinted in Lintner. 9th Rep't. 1893. p. 402
Typhlocyba vulnerata Woodworth. Psyche. 1889. 5: 213

Abundant on grape vines and occurring everywhere that its food plant is found.

Typhlocyba querci Fitch

Empoa querci Fitch. Homop. N. Y. State Cab. 1851. p. 63; reprinted in Lintner. 9th Rep't. 1893. p. 403
Typhlocyba querci Woodworth. Psyche. 1889. 5: 214.

Fitch says, "On oaks, sometimes excessively numerous." An interesting variety with long dusky spots in outer ends of discal cells was sent to me by Mr Van Duzee, collected at Lake Placid.

The variety bifasciata Gill is reported by Mr Van Duzee for Lake Placid, Phoenicia and Kingston.

Typhlocyba ulmi Linnaeus

Cicada ulmi Linnaeus. Fauna Suecica. 1761. p. 900.
Anomia ulmi Fieber. Kat. d eur. Cicad. 1872. p. 15
Typhlocyba ulmi Puton. Cat. Hemip. Palae. 1886. p. 88

Gillette says, "I received a good many males and females of this species from Dr Lintner labelled, 'Albany, N.Y., 1886.'"

Typhlocyba rosae Linnaeus

Cicada rosae Linnaeus
Typhlocyba rosae Tollin. Ent. Zeit. v. Stett. 1851. p. 67
Tettigonia rosae (Harris) Harris. Ins. Inj. to Veg. ed. 2. 1852. p. 192
Typhlocyba rosae Woodworth. Psyche. 1889. 5: 214

Abundant everywhere on roses and other plants.

Typhlocyba illinoiensis Gillette

Collected at Hamburg N. Y. by Mr E. P. Van Duzee.

LIST OF HEMIPTERA TAKEN IN THE ADIRONDACK MOUNTAINS

BY E. P. VAN DUZEE

During the past summer I had occasion to spend a few days collecting Hemiptera about Lake Placid in the Adirondacks and at the suggestion of Dr E. P. Felt I have gotten together some brief notes on these, incorporating with them a few observations I made in one day's collecting on the grounds of the Lake Placid Club, Sep. 22, 1902, and adding the Hemiptera recorded from Axton by Professor MacGillivray.[1] My collecting at Lake Placid the present season [1904] was included between Aug. 10 and 15 and embraced the following localities: one hour's work near the railway station at Saranac Lake Junction between 7 a.m. and 8 a.m. while waiting for a train; one day's work along the borders of a swampy woods immediately before the Isham House; one day on and about Cobble hill, a rocky and partially wooded elevation of about 600 feet behind the Forest View House; one day and a half in the deep rich woods and along the road between Isham's and Wilmington Notch extending as far east as the bridge over the Ausable river; a little work in and between showers in the woods about "Balance rock;" and one half hour spent on the bald summit of Mt Whiteface with a few things taken along the trail on its slopes. The weather was generally cold and rainy and much of my work was done in a chilling mist driven by a cold north wind. With warm sunny weather the results of the six days spent there would certainly have been very different. As it was I took some interesting forms among which were four that Professor Osborn considers new, the descriptions of which he will publish shortly, and three or four others that may prove to be still undescribed.

A comparison of this list with the *List of the Hemiptera of the Muskoka Lake District of Canada* published by me in the *Canadian Entomologist* for 1889 will show that the faunas of these regions are very similar and differ from that of western New York mostly by the presence of such species as Oncometopia costalis, Philaenus lineatus, and Homoemus aeneifrons, species characteristic of a region of rocks and sand.

[1]Ent. News. 14: 263. 1903.

There is still much work to be done before we can form any very accurate estimate of the insect fauna of our own State. Certain portions have been fairly well worked and a few faunal papers have been published giving the results of such work. Of the hemipterous fauna even less is known than of some of the other insect orders. Four papers on the New York hemipterous fauna have appeared: Fitch's *Catalogue of the Homopterous Insects in the New York State Cabinet of Natural History*, published in 1851; my own *List of the Hemiptera of Buffalo and Vicinity*, published in the bulletin of the Buffalo Society of Natural Sciences, 1894, v.5; Dr Southwick's *Notes on Local* [New York city] *Jassidae, Bythoscopidae, Cercopidae, Membracidae, and Fulgoridae* published in volume 19 of *Science;* and lastly the few hemiptera included in the list of insects taken in the Adirondack mountains by Prof. A. D. MacGillivray and C. O. Houghton, in volumes 13 and 14 of *Entomological News*. Dr Fitch's paper is one of the most valuable contributions to our knowledge of the North American Homoptera and is indispensable to the student on account of the many new species described. My own paper lists 381 species and does not include the Psyllidae, Aphididae or Coccidae.

A few lists of Hemiptera from regions adjacent to New York State have been published and will be useful by way of comparison with our own fauna. Among these may be mentioned the following:

Harris. List of Insects. Hitchcock's Report on the Geology, Mineralogy, Botany and Zoology of Massachusetts, 1835. ed. 3.

Rathvon. List of Insects. Mombert's History of Lancaster Co., Pa. 1869.

Provancher. Petite Faune Entomologique du Canada. 1886–90. v. 3, Les Hemipteres.

Van Duzee. List of Hemiptera from the Muskoka Lake District, Canada. Can. Ent. 1889, v. 21.

Smith. Catalogue of the Insects found in New Jersey. 1900. ed.2.

Harrington. Fauna Ottawaensis, Hemiptera. Ottawa Nat. 1892. v. 6; 1894. v. 8.

Slosson. Lists of Insects Taken in the Alpine Region of Mt Washington. Ent. News. 1894. v. 5; sup. in subsequent volumes.

Osborn. List of the Hemiptera of Ohio.

Published quite recently. I have not yet seen this paper but understand that it is a preliminary list merely.[1]

[1] Since this paper was prepared a *Preliminary List of the Hemiptera of Western Pennsylvania* by P. M. Wirtner has appeared in v. 3, no. 1, of the *Annals of the Carnegie Museum*. This list enumerates 416 species and is well up to date in its nomenclature. It is the best local list of the North American Hemiptera that has yet appeared so far as I am aware.

Of the papers here enumerated that by MacGillivray and Houghton is the only one treating of the hemipterous fauna of the Adirondack region, and the few species there listed have been included in the present list. Further collecting in this wild and mountainous portion of our State will certainly add many species to the present very imperfect enumeration of its interesting hemipterous fauna, especially among those forms that are characteristic of the Canadian region. This list is published with a full appreciation of its fragmentary character but with the belief that it will make a useful addition to our knowledge of the hemipterous fauna of New York State.

PENTATOMIDAE

Homoemus aeneifrons Say. This insect proved to be very generally distributed and common in the Adirondacks where there were low marshy spots with carices intermixed with the swamp grasses. I took the young with the adults on a species of Scirpus on the summit of Cobble Hill. On Sep. 22, 1902, I found them equally abundant but then all seemed to have reached maturity.

Sehirus cinctus P. B. I took this species occasionally wherever I collected about Lake Placid but in one field immediately behind the Isham House I found them in unnumbered thousands. The weather was cold and when the sun would shine these insects, at that time [Aug. 12] mostly in the larval state, would gather in dense masses as large over and as thick as one's hand, on the sides of logs and stones or wherever the bare ground would draw the heat of the sun. A week later these larvae were rapidly reaching the adult state. I found the food plant of this species was a low hirsute labiate plant called "horse nettle" by the farmers about there.

Euschistus fissilis Uhler. Recorded from Axton by Professor MacGillivray.

Euschistus tristigmus Say. Also taken by Professor MacGillivray at Axton. I saw numbers of the young of this and other pentatomids while collecting in August but the season was not far enough advanced for me to obtain the adults.

Coenus delius Say. Taken at Axton by Professor MacGillivray.

Neottiglossa undata Say. I captured this species along the road toward Wilmington Notch. In determining the material taken by Professor MacGillivray I inadvertently wrote Mormidea undata and the species was so entered in his list.

Cosmopepla carnifex Fabr. Taken at Axton by Professor MacGillivray.

Podisus sereiventris Uhler. One fine large specimen of this species was taken on the grounds of the Lake Placid Club on Aug. 15. It was also taken by Professor MacGillivray at Axton.

Podisus maculiventris Say. This species and the next were among the material taken at Axton by Professor MacGillivray.

Podisus modestus Dallas. With the preceding.

Acanthosoma lateralis Say. I took a few examples of this species in beating trees. Professor MacGillivray seems to have found it more abundant at Axton.

Acanthosoma cruciata Say. Taken by Professor MacGillivray at Axton.

COREIDAE

Protenor belfragei Haglund. Taken in numbers on a tall coarse grass by the Wilmington road near the Ausable river.

Corizus novaeboracensis Sign. Not uncommon in the fields about the Lake Placid Club grounds, Aug. 12 and Sep. 22.

Corizus nigristernum Sign. Common everywhere.

LYGAEIDAE

Nysius angustatus Uhler. Common August 1904 and September 1902.

Nysius sp. One example taken near the Ausable river of a species I have not yet been able to determine.

Ischnorhynchus resedae Panzer (**didymus** Zett.) Taken at Saranac Lake and elsewhere.

Phlegyas abbreviatus Uhler. Taken at Axton by Professor MacGillivray. This species is certainly quite distinct from annulicrus Stal which is a more western form occurring from Kansas through the Rocky mountain region.

Cymus angustatus Stal. Common.

Cymus claviculus Fallen. I took this species on the bald summit of Mt Whiteface and found it abundant on the lower levels, August and September.

Ligyrocoris sylvestris Linn. Taken on the summit of Mt Whiteface and abundantly everywhere in the fields about Lake Placid.

Ligyrocoris contracta Say. Less abundant than sylvestris. This insect is hardly distinguishable from that determined by me as Ligyrocoris balteatus Stal in Dr Skinner's list of insects taken at Beulah N. M. If that determination was correct Stal's species may have to fall as a synonym. The species I identify as Say's constricta is a Pamera (according to Heidemann) proportionately longer and more slender than Perigenes fallax Heid. I have taken it about Buffalo and at Phoenicia in the Catskills.

TINGIDAE

Corythuca juglandis Fitch. Taken occasionally.

Physatochila plexa Say. Taken by Professor MacGillivray at Axton.

ARADIDAE

Aradus 4-lineatus Say. One young example of the species that passes for 4-lineatus was taken on Cobble Hill.

Aradus niger Stal. I captured an immature example of this species in the dense woods near the Ausable river. I have already recorded the occurrence of this species about Buffalo [Ent. News, 13: 23] and Mr Heidemann records its capture at Washington D. C. and Kirbyville Tex. Stal described it from South Carolina.

Aradus abbas Bergr. Taken at Axton by Professor MacGillivray.

HYDROMETRIDAE

Rhagovelia obesa Uhler. Taken in numbers from the surface of the Ausable river beneath the Wilmington road bridge.

Microvelia americana Uhler. From the pond in the golf links of the Lake Placid Club. Also taken from a small ditch of running water near the Ausable river.

GERRIDAE

Hygrotrechus remigis Say. Lower slopes of Mt Whiteface. Also recorded from Axton by Professor MacGillivray.

REDUVIDAE

Coriscus ferus Linn. Common.

Coriscus rufusculus Reut. Taken at nearly all stations.

Coriscus inscriptus Kirby. This species was amongst the material taken by Professor MacGillivray at Axton.

Coriscus vicarius Reut. Numerous brachypterous examples and one fully winged one were taken by me from the rank vegetation growing in the low swampy woods along the road from Isham's to the Ausable river. I also took it in a tamarack swamp near Lake Placid in September 1902.

Coriscus subcoleoptratus Kirby. Recorded from Axton by Professor MacGillivray.

Sinea diadema Fabr. Not uncommon.

SALDIDAE

Salda pallipes Fabr. Common.

Salda deplanata Uhler. Taken at Axton by Professor MacGillivray.

ANTHOCORIDAE

Anthocoris musculus Say. Common.

Anthocoris sp. Two examples taken on the golf links of the Lake Placid Club.

Piezostethus galactinus Fieb. Lake Placid, Sep. 22, 1902.

Triphleps insidiosus Say. Taken on the summit of Mt Whiteface.

CAPSIDAE

Trigonotylus ruficornis Fallen. Common.

Leptopterna dolobrata Linn. Another common species.

Miris affinis Reut. Abundant here as elsewhere.

Miris rubellus Uhler. Taken about the Lake Placid Club grounds as well as on my former visit in September 1902. This species seems to grade into the darker specimens of affinis.

Collaria meilleuri Prov. Common, August and September.

Lopidea media Say. Occasional.

Diommatus congrex Uhler. I have taken this on willows both here and at Buffalo.

Cyrtorrhinus marginatus Uhler. One example taken near the Ausable river.

Phytocoris eximus Reut. Taken on the summit of Mt Whiteface and common elsewhere.

Phytocoris breviusculus Reut. From the Lake Placid Club grounds.

Compsocerocoris annulicornis Reut. Taken on Cobble Hill.

Neurocolpus nubilus Say. Not uncommon.

Calocoris rapidus Say. Taken on the summit of Mt Whiteface and elsewhere.

Calocoris tinctus Uhl.? From Cobble Hill and vicinity.

Melinna modesta Uhler. Swept from bushes in low woods near the Ausable river.

Lygus pratensis Linn. Common everywhere.

Lygus pabulinus Linn. Generally distributed in wooded areas.

Lygus invitus Say. Common.

Lygus invitus Say var. Summit of Mt Whiteface and in wooded places about Lake Placid. This is a rather larger form than invitus, and stouter built and more deeply colored.

Lygus sp. nov. Taken on the golf links.

Lygus hirticulus Uhl. M. S. Several taken in the dense woods along the valley of the Ausable river.

N. gen. et sp. near **Neaborus.** Three examples from near the Ausable river.

Poeciloscytus unifasciatus Fabr. Taken in the heavy woods along the Wilmington road.

Poecilocapsus lineatus Fabr. Occasional.

Systratiotus venaticus Reut. Not uncommon. A variety with the cuneus black occurred in the low lands near the Ausable river.

Camptobrochis grandis Uhler. Common. August to September.

Camptobrochis nebulosus Uhler. Generally distributed and moderately abundant.

Labops hesperius Uhler. Taken at Axton by Professor MacGillivray.

Monolocoris filicis Linn. Common on ferns in woodlands here as elsewhere.

Hyaliodes vitripennis Say. Beaten from bushes near Saranac Lake Aug. 10.

Sthenarops malina Uhler. Taken on the rank vegetation near the Ausable river.

Pilophorus clavipes Uhler. M. S. Swept from low huckleberry bushes on the summit of Mt Whiteface and of common occurrence elsewhere on pine trees.

Stiphrosoma stygica Say. Common.

Stiphrosoma croseipes Uhl. One example from near the Ausable river.

Halticus apterus Linn. From woodlands near the Ausable river.

Mecomma gilvipes Stal. Taken in numbers in the open swampy woods on the bottom lands along the Ausable river.

Dicyphus famelicus Uhler. Reported from Axton by Professor MacGillivray.

Dicyphus agilis Uhler. From the summit of Mt Whiteface and not uncommon elsewhere.

Diaphnidia pellucida Uhler. Common on trees.

Rhinocapsus vanduzei Uhler. Beaten from red raspberry bushes among the rank vegetation in open swampy woods near the Ausable river. About Buffalo and wherever else I have taken this pretty species it has always been in just such humid and shady situations. At Buffalo it is most abundant about the first week in July.

Orthotylus chlorionis Say. Common.

Dichrooscytus elegans Uhler. Taken on cedar bushes here as elsewhere.

Plagiognathus obscurus Uhler. Taken on the summit of Mt Whiteface and abundant at lower levels.

Plagiognathus politus Uhler. Common.

Plagiognathus fraternus Uhler. Captured near Isham's.

Chlamydatus pulicarius Fallen. Common. In using this name in place of Agalliastes I follow Hüeber's *Catalogue* as the most convenient accessible authority.

Psallus n. sp. Captured on the golf links.

NOTONECTIDAE

Notonecta undulata Say. Dredged from the pond in the golf links.

Buenoa platycnemis Fieb. One example taken with the preceding species.

CORIXIDAE

Corixa sp. One small Corixa was taken in the pond with the foregoing species.

HOMOPTERA

MEMBRACIDAE

Campylenchia curvata Fabr. Rich woods near the Ausable river.

Ceresa turbida Godg. Varying in color from green to almost uniformly black. It was common on willows and alders. Professor Osborn has informed me that he has redescribed this species as Ceresa melanogaster in Bul. Nat. Hist. Lab. Iowa State Univ., Jan. 1893. 2:290.

Ceresa diceros Say. On elder bushes, occasional.

Stictocephala lutea Walk. Taken at Axton by Professor MacGillivray.

Carynota marmorata Say. One example taken near the banks of the Ausable river.

Telamona reclivata Fitch. Cobble Hill. One example beaten from a Cottonwood tree.

Telamona sp. One individual taken in the woods near the Ausable river.

FULGORIDAE

Scolops sulcipes Say. Taken on the summit of Mt Whiteface and elsewhere.

Cixius coloepium Fitch. Taken on the summit of Mt Whiteface and common everywhere on huckleberries, August and September.

Cixius stigmatus Say. Taken with the preceding in numbers.

Megamelus notulus Germ. Sep. 22, 1902, on the grounds of the Lake Placid Club.

Pissonotus dorsalis VanD. Swept from weeds.

Stenocranus dorsalis Fitch. Swept in numbers from a swampy spot Sep. 22, 1902.

Laccocera vittipennis VanD. Taken by me on Cobble Hill and at Axton by Professor MacGillivray.

Liburnia pellucida Fabr. One male taken on the slopes of Mt Whiteface.

Liburnia puella VanD. Taken with the preceding.

Liburnia laminalis VanD. A female taken on the summit of Mt Whiteface has the venter black.

Liburnia lutulenta VanD. Very abundant everywhere. I took one macropterous male with the abdomen mostly black.

Liburnia campestris VanD. I captured a single example of this tiny species near Isham's. It however is doubtless abundant in the Adirondacks.

Lamenia vulgaris Fitch. Not common.

Bruchomorpha oculata Newmn. Generally distributed throughout the district collected over, and taken on Sep. 22, 1902.

Peltonotus histrionicus Stal. Cobble Hill, one example. Also taken on the club grounds on Sep. 22, 1902.

CERCOPIDAE

Lepyronia 4-angularis Say. Common.

Aphrophora 4-notata Say. Occasional.

Philaenus lineatus Linn. Summit of Mt Whiteface. Also taken in abundance everywhere I have collected in the Adirondacks.

Clastoptera obtusa Say. Common.

Clastoptera proteus Fitch. Swept from a Cornus bush by the Wilmington road on the banks of the Ausable river.

TETTIGONIDAE

Oncometopia costalis Fabr. Common everywhere with its young.

Tettigonia gothica Sign. Another common species. This is the insect listed as T e t t i g o n i a h i e r o g l y p h i c a by Harrington from Ottawa, by Provancher from Quebec, and by myself from Muskoka and Buffalo N.Y.

Diedrocephala coccinea Forst. Rich woods near the Ausable river, and on the club grounds, Sep. 22, 1902.

Draeculacephala mollipes Say. Common. Prof. E. D. Ball has established the genus Draeculacephala for those species of the old genus Diedrocephala that have the head more pointed.

Draeculacephala novaeboracensis Fitch. Abundant in places.

Helochara communis Fitch. I noted the occurrence of this common insect during my collecting about Lake Placid.

Eucanthus acuminatus Fabr. (**orbitalis** Fitch). A few examples were taken in open woods on the slopes of Mt Whiteface and on Cobble Hill.

Gypona quebecensis Prov. Taken in the woods near Isham's.

BYTHOSCOPIDAE

Bythoscopus cognatus VanD. A few taken on Cobble Hill.

Bythoscopus minor Fitch. One example from the low woods along the Ausable river.

Bythoscopus pruni Prov. Abundant everywhere in the Adirondacks on birch and alder.

Pediopsis viridis Fitch. Common on willows.

Pediopsis trimaculata Fitch. Taken at Axton by Professor MacGillivray. This is the trimaculata of my catalogue not my insignis which Osborn and Ball now place as Fitch's trimaculata.

Pediopsis canadensis VanD. Two examples were beaten from alder bushes on the Lake Placid Club grounds.

Pediopsis basalis VanD. One dark specimen taken on Cobble Hill.

Idiocerus pallidus Fitch. Common.

Idiocerus suturalis Fitch. Abundant everywhere on poplars.

Idiocerus suturalis var. **lunaris** Ball. This variety or race occurred here as elsewhere with the typical suturalis. Whatever its relationship may be with that species it certainly should have a name by which it may be distinguished therefrom.

Idiocerus alternatus Fitch. Not common.

Idiocerus lachrymalis Fitch. Taken on the summit of Mt Whiteface and at other places on Populus grandidentata. The males of this species are much smaller than the females and somewhat resemble alternatus.

Idiocerus provancheri VanD. One example beaten from a thorn bush.

Agallia novella Say. Occasional.

Agallia 4-punctata Prov. Taken on the summit of Mt Whiteface and elsewhere.

Agallia sanguinolenta Prov. Common.

JASSIDAE

Xestocephalus pulicarius VanD. Taken at Lake Placid, Sep. 22, 1902.

Paramesus vitellinus Fitch. One example from Cobble Hill.

Platymetopius acutus Say. Common.

Deltocephalus configuratus Uhler. Not uncommon. One darkly colored female was taken on the summit of Mt Whiteface.

Deltocephalus minki Fieber. Taken Sep. 22, 1902, near Lake Placid. On Aug. 25 of this year [1904] I swept numbers of them from grass on the hillsides at Phoenicia in the Catskills.

Deltocephalus sylvestris O. & B. Taken in open woods near the Ausable river and on Cobble Hill.

Deltocephalus melscheimeri Fh. Several taken on Cobble Hill and elsewhere. This is the smallest species of Deltocephalus known to me.

Deltocephalus debilis Uhler. Common in all gradations from the pale yellowish forms to those with black elytra.

Deltocephalus sayi Fitch. Summit of Mt Whiteface and elsewhere.

Deltocephalus compactus O. & B. Taken September 22, 1902.

Deltocephalus sp. One example from Cobble Hill.

Deltocephalus apicatus O. & B. One dark example with the elytral nervures distinctly pale was taken on the summit of Mt Whiteface.

Deltocephalus inimicus Say. Abundant everywhere.

Athysanus venosus Osb. One large pale female was taken on the summit of Mt Whiteface.

Athysanus extrusus VanD. Taken at Axton by Professor MacGillivray.

Athysanus vaccini VanD. From the slopes of Mt Whiteface and on Cobble Hill.

Athysanus plutonius Uhler. Occasional. One example from Cobble Hill being very pale. I also took this species at Lake Placid on Sep. 22, 1902.

Athysanus anthracinus VanD. Taken at Axton by Professor MacGillivray.

Athysanus curtisii Fitch. Not uncommon. August and September.

Athysanus sp. One pair swept from rank grasses in an opening in the forest on the slopes of Mt Whiteface.

Athysanella acuticauda Baker. Professor MacGillivray took this species at Axton and I swept several from grass on Cobble Hill and in that vicinity.

Phlepsius fulvidorsum Fitch. Taken occasionally on deciduous trees and balsams about Lake Placid.

Phlepsius apertus VanD. One male and two females taken in rich woods near the Ausable river.

Phlepsius incisus VanD. Three examples taken with the preceding species and at Saranac Lake. I was surprised not to find the common and universally distributed Phlepsius irroratus in my material when I reached home. It is doubtless common about Lake Placid.

Scaphoideus immistus Say. Occasional.

Thamnotettix clitellaria Say. Not uncommon.

Thamnotettix kennicotti Uhler. One example taken on Cobble Hill.

Thamnotettix decipiens Prov. Swept in large numbers from a tall swamp grass at Lake Placid on Sep. 22, 1902. I also took it in a swampy spot near the Ausable river in August 1904.

Thamnotettix inornata VanD. A few examples swept from tall grasses near the Ausable river.

Thamnotettix placidus Osb. Taken in numbers with the preceding.

Thamnotettix infuscata G. & B. Taken at various localities about Lake Placid, specially in wooded areas near the Ausable river.

Chlorotettix unicolor Fitch. Common, August and September.

Chlorotettix tergatus Fitch. With the preceding.

Chlorotettix viridia VanD. Taken at Lake Placid.

Chlorotettix lusoria O. & B. One example taken near the Ausable river. Also taken Sep. 22, 1902.

Cicadula 6-notata Fallen. Summit of Mt Whiteface and more abundantly on the lower levels about Lake Placid.

Cicadula slossoni VanD. Common in grass on the Lake Placid Club grounds. The males are considerably smaller and darker in color than the females.

Cicadula variata Fall. One pale example.

Gnathodus punctatus Thungb. Common.

Gnathodus viridis Osb. One example taken on the summit of Mt Whiteface.

TYPHLOCYBIDAE

Dicraneura communis Gillette. Several examples were taken on the summit of Mt Whiteface. I have also taken this species at Phoenicia, Ulster co., and at Lancaster, Erie Co., N.Y.

Empoasca atrolabis Gillette. Not uncommon on bushes in open woods.

Empoasca flavescens Fabr. One example from near the Ausable river.

Eupteryx vanduzei Gillette. One example taken in the rich swampy woods near Isham's. This specimen has the costa conspicuously pale yellow bordered within by a black vitta.

Eupteryx flavoscuta Gillette. A very dark specimen is among the material taken on the summit of Mt Whiteface. Others were taken on Cobble Hill and in that vicinity. It lives on ferns and is widely distributed.

Typhlocyba rosea Linn. From the golf links of the Lake Placid Club.

Typhlocyba tenerrima H. S. One example from near the Ausable river.

Typhlocyba querci Fitch. Summit and slopes of Mt Whiteface. I also took this species at Kingston and Phoenicia in the Catskills.

Typhlocyba sp. Beaten from a thorn bush in an opening in the woods near "Balance rock."

PSYLLIDAE

Trioza tripunctata Fitch. Taken at Axton by Professor MacGillivray.

Psylla sp. Six species of this genus and three of Livia were taken by me about Lake Placid. So little has been done with our North American species in this family that it is quite useless to attempt the determination of our material at present. Probably no family of our Hemiptera is so much in need of careful and conscientious study by a competent student as this.

LIST OF LEPIDOPTERA TAKEN AT KEENE VALLEY N.Y.

BY G. F. COMSTOCK

With additions from State Museum records

The following list of species has been kindly placed at our disposal for publication by Mr G. F. Comstock. His list of captures have been supplemented by records taken from the New York State collection, the added species being indicated by a star. He has been kindly assisted in many identifications by Messrs G. Franck, W. D. Kearfott, and W. Beutenmuller.

Papilionidae

Papilio glaucus *Linn.*
P. polyxenes *Fabr.*

Pieridae

Pieris napi *Linn.*
P. rapae *Linn.*
Eurymus philodice *Godt.*
E. interior *Scudd.*

Nymphalidae

Argynnis cybele *Fabr.*
A. aphrodite *Fabr.*
A. atlantis *Edw.*
Brenthis myrina *Cram.*
B. bellona *Fabr.*
Euphydryas phaeton *Dru.*
Phyciodes tharos *Dru.*
P. batesii *Reakirt*
Polygonia comma *Harr.*
P. faunus *Edw.*
P. gracilis *G. & R.*
P. progne *Cram.*
Eugonia j-album *Boisd. & Lec.*
Euvanessa antiopa *Linn.*
Aglais milberti *Godt.*
Vanessa atalanta *Linn.*
V. huntera *Fabr.*
V. cardui *Linn.*
Basilarchia arthemis *Dru.*
B. archippus *Cram.*

Agapetidae

Cercyonis alope *Fabr.* c. nephele *Kirby*
Enodia portlandia *Fabr.*
Cissia eurytus *Fabr.*

Lymnadidae

Anosia plexippus *Linn.*

Lycaenidae

Feniseca tarquinius *Fabr.*
Chrysophanus thoe *Boisd.*
Epidemia epixanthe *Boisd. & Lec.*
Heodes hypophleas *Boisd.*
Cyaniris ladon *Cram.*
Everes comyntas *Godt.*

Hesperidae

Amblyscirtes vialis *Edw.*
A. samoset *Scudd.*
Pamphila palaemon *Pallas*
Atrytone hobomok *Harr.*
Erynnis sassacus *Harr.*
Anthomaster leonardus *Harr.*
Thymelicus otho *S. & A.* a. egeremet *Scudd.*
T. mystic *Scudd.*
T. cernes *Boisd. & Lec.*
Polites peckius *Kirby*
Thorybes pylades *Scudd.*
Thanaos icelus *Lint.*
T. lucilius *Lint.*

Sphingidae

Hemaris diffinis *Boisd.*
H. thysbe *Fabr.*
*Deilephila gallii *Rott.*
D. lineata *Fabr.*
Pholus pandorus *Hübn.*
Ampelophaga choerilus *Cram.*
Sphinx kalmiae *S. & A.*
S. drupiferarum *S. & A.*
S. chersis *Hübn.*
Ceratomia undulosa *Walk.*
Marumba modesta *Harr.*
Smerinthus jamaicensis *Dru.*
S. cerysii *Kirby*
*Paonias excaecatus *S. & A.*
*Cressonia juglandis *S. & A.*

Saturniidae

Tropaea luna *Linn.*
Telea polyphemus *Cram.*
Automeris io *Fabr.*

Syntomidae

*Scepsis fulvicollis *Hübn.*
Lycomorpha pholus *Dru.*
Ctenucha virginica *Charp.*

Lithosiidae

Lexis bicolor *Grt.*
*Hypoprepia miniata *Kirby*

Arctiidae

Eubaphe immaculata *Reak.*
E. aurantiaca *Hübn.*
Haploa lecontei *Boisd.*
H. confusa *Lyman*
Isia isabella *S. & A.*
Phragmatobia fuliginosa *Linn.*
*Diacrisia virginica *Fabr.*
Apantesis virgo *Linn.*
A. intermedia *Stretch*
A. parthenice *Kirby*
*A. arge *Dru.*
Arctia caia *Linn.* a. americana *Harr.*
Halisidota tessellaris *S. & A.*

Noctuidae

Raphia frater *Grote*
Apatela americana *Harr.*
A. dactylina *Grote*
A. morula *Grote*
*A. interrupta *Guen.*
A. hamamelis *Guen.*
A. fragilis *Guen.*
A. impressa *Walk.*
Arsilonche albovenosa *Goeze*
*Microcoelia dipteroides *Guen.*
Chytonix palliatricula *Guen.*
Baileya ophthalmica *Guen.*
Platysenta videns *Guen.*
Balsa malana *Fitch*
Caradrina miranda *Grote*
Perigea vecors *Guen.*
Oligia exesa *Guen.*
Hadena binotata *Walk.*
H. genetrix *Grote*
H. mactata *Guen.*
H. stipata *Morr.*
H. apamiformis *Guen.*
H. lateritia *Hübn.*
*H. dubitans *Walk.*
H. devastatrix *Brace*
H. arctica *Boisd.*
H. lignicolor *Guen.*
Dryobota illocata *Walk.*
*Hyppa xylinoides *Guen.*
Euplexia lucipara *Linn.*
*Actinotia ramosula *Guen.*
Pyrophila pyramidoides *Guen.*
Rhynchagrotis gilvipennis *Grote*
R. anchocelioides *Guen.* a. brunneipennis *Grote*
R. alternata *Grote*
Adelphagrotis prasina *Fabr.*
Eueretagrotis sigmoides *Guen.*
E. perattenta *Grote*
Semiophora elimata *Guen.* b. janualis *Grote*
*Agrotis ypsilon *Rott.*
*A. geniculata *G. & R.*
*A. astricta *Morr.*
*Peridroma margaritosa *Haw.* a. saucia *Hübn.*
Noctua smithii *Snell.*
N. normaniana *Grote*

N. bicarnea *Guen.*
N. c-nigrum *Linn.*
N. jucunda *Walk.*
N. phyllophora *Grote*
*N. plecta *Linn.*
N. collaris *Grt. & Rob.*
N. haruspica *Grote*
N. clandestina *Harr.*
Feltia subgothica *Haw.*
F. jaculifera *Guen.*
a. herilis *Grote*
*Paragrotis scandens *Riley*
P. insulsa *Walk.*
*P. tessellata *Harr.*
P. redimicula *Morr.*
Mamestra nimbosa *Guen.*
M. imbrifera *Guen.*
M. purpurissata *Grote*
M. lustralis *Grote*
*M. meditata *Grote*
M. detracta *Walk.*
M. grandis *Boisd.*
M. latex *Guen.*
*M. adjuncta *Boisd.*
M. goodelli *Grote*
M. renigera *Steph.*
*M. olivacea *Morr.*
M. lorea *Guen.*
Nephelodes minians *Guen.*
*Heliophila unipuncta *Haw.*
H. pseudargyria *Guen.*
H. luteopallens *Smith*
H. albilinea *Hübn.*
H. insueta *Guen.*
H. commoides *Guen.*
Orthodes crenulata *Butl.*
O. vecors *Guen.*
Graphiphora peredia *Grote*
*Tricholita signata *Walk.*
Lithomoia germana *Morr.*
Litholomia napae *Morr.*
Calocampa curvimacula *Morr.*
*Cucullia convexipennis *Grt.& Rob.*
*C. asteroides *Guen.*
*C. intermedia *Speyer*
Gortyna americana *Speyer*
Papaipema harrisii *Grote*
Brotolomia iris *Guen.*
Trigonophora periculosa *Guen.*
Eucirroedia pampina *Guen.*
Scoliopteryx libatrix *Linn.*
Cosmia paleacea *Esper.*
Orthosia bicolorago *Guen.*
O. helva *Grote*
Ipimorpha pleonectusa *Grote*
Rhodophora florida *Guen.*
Euthisanotia grata *Fabr.*
Calpe canadensis *Beth.*
Panchrysia purpurigera *Walk.*
Plusia aerea *Hübn.*
P. aeroides *Grote*
P. balluca *Geyer*
*Euchalcia contexta *Grote*
Autographa bimaculata *Steph.*
*A. precationis *Guen.*
A. octoscripta *Grote*
A. rectangula *Kirby*
*A. u-aureum *Guen.*
A. ampla *Walk.*
A. falcigera *Kirby* a. simplex *Guen*
Ambrostola urentis *Guen.*
Eustrotia synochitis *Grt. & Rob.*
E. musta *Grt. & Rob.*
E. muscoscula *Guen.*
E. carneola *Guen.*
Eumestleta flammicincta *Walk*
Chamyris cerintha *Treits.*
*Metathorasa monitifera *Guen.*
*Euherrichia mollissima *Guen.*
Drasteria erechtea *Cram.*
Euclidia cuspidea *Hübn.*
Catocala relicta *Walk.*
C. concumbens *Walk.*
C. unijuga *Walk.*
C. coccinata *Grote* a. sinuosa *Grote*
C. cerogama *Guen.*
Panapoda rufimargo *Hübn.*
Parallelia bistriaris *Hübn.*
*Epizeuxis americalis *Guen.*
E. aemula *Hübn.*
E. lubricalis *Geyer*
Zanclognatha laevigata *Grote*
Z. marcidilinea *Grote*
Chytolita petrealis *Grote*
Renia discoloralis *Guen.*
R. fraternalis *Smith*
R. flavipunctalis *Geyer*
Heterogramma pyramusalis *Walk.*
Palthis angulalis *Hübn.*
Bomolocha scutellaris *Grote*
B. deceptalis *Walk.*

Notodontidae

Melalopha albosigma *Fitch*
Notodonta basitriens *Walk.*
Pheosia dimidiata *Herr.-Schaef.*
Nadata gibbosa *S. & A.*
Symmerista albifrons *S. & A.*
Heterocampa manteo *Double*
H. biundata *Walk.*
H. guttivitta *Walk.*
Schizura unicornis *S. & A.*
Gluphisia septentrionalis *Walk.*
*Ellida caniplaga *Walk.*

Thyatiridae

*Habrosyne scripta *Gosse.*
H. rectangulata *Ottolengui*
Pseudothyatira cymatophoroides *Guen*
*P. expultrix *Grote*

Liparidae

*Notolophus antiqua *Linn.*
Hemerocampa leucostigma *S. & A.*
Olene plagiata *Walk.*

Lasiocampidae

Malacosoma americana *Fabr.*

Platypterygidae

Eudeilinea herminiata *Guen.*
Oreta rosea *Walk.*
Drepana arcuata *Walk.*

Geometridae

Eudule mendica *Walk.*
Carsia paludata *Thunb.*
Nannia morensata *Hulst.*
*Tephroclystis luteata *Pack.*
T. interruptofasciata *Pack.*
T. absinthiata *Clerck*
Eucymatoge intestinata *Guen.*
Venusia cambrica *Curtis*
Euchoeca albovittata *Guen.*
E. lucata *Guen.*
Hydria undulata *Linn.*
Eustroma diversilineata *Hübn.*
*E. testata *Linn.*
*E. populata *Linn.*
E. destinata *Möschl.*
E. prunata *Linn.*
Rheumaptera hastata *Linn.*
Mesoleuca ruficilliata *Guen.*
M. gratulata *Walk.*
M. lacustrata *Guen.*
M. truncata *Hufn.*
Hydriomena latirupta *Walk.*
H. custodiata *Guen.*
H. unangulata *Haw.*
Coenocalpe magnoliata *Guen.*
Marmopteryx marmorata *Pack.*
*Gypsochroa designata *Hufn.*
G. sitellata *Guen.*
Petrophora ferrugata *Clerck*
P. fluctuata *Linn.*
Synelys alabastaria *Hübn.*
S. ennucleata *Guen.*
Cinglis purata *Guen.*
Leptomeris quinquelinearia *Pack.*
Eois inductata *Guen.*
Annemoria bistriaria *Pack.*
Nemoria pistaceata *Guen.*
Eufidonia notataria *Walk.*
Orthofidonia vestaliata *Guen.*
Physostegania pustularia *Guen.*
Sciagraphia flavivenata *Hulst.*
S. granitata *Guen.*
*S. mellistrigata *Grote*
Philobia notata *Linn.*
P. enotata *Guen.*
*Cymatophora ribearia *Fitch*
C. subcessaria *Walk.*
Apaecasia defluata *Walk.*
Caripeta divisata *Walk.*
Nepytia semiclusaria *Walk.*
Selidosema humarium *Guen.*
Cleora indicataria *Walk.*
C. pampinaria *Guen.*
C. larvaria *Guen.*
Melanolophia canadaria *Guen.*
Glena cognataria *Hübn.*
Ectropis crepuscularia *D. & S.*
Lycia cognataria *Guen.*
Lychnosea intermicata *Walk.*
Therina fervidaria *Hübn.*
Metrocampa praegrandaria *Guen.*
Eugonobapta nivosaria *Guen.*
Ennomos subsignarius *Hübn.*
*E. magnarius *Guen.*
Xanthotype crocataria *Fabr.*
Plagodis serinaria *Herr.-Schaef.*
Hyperitis amicaria *Herr.-Schaef.*
Ania limbata *Haw.*
Gonodontis hypochraria *Herr.-Schaef.*
Euchlaena obtusaria *Hübn.*
*E. johnsonaria *Fitch*
E. astylusaria *Walk.*
E. pectinaria *D. & S.*
Metanema inatomaria *Guen.*
M. determinata *Walk.*
M. textrinaria *Grt. & Rob.*
Azelina ancetaria *Hübn.*
Caberodes confusaria *Hübn.*
C. majoraria *Guen.*
Tetracis crocallata *Guen.*
Sabulodes transversata *Dru*

Epiplemidae

Callizzia amorata *Pack.*

Nolidae

Nola ovilla *Grote*

Sesiidae

Sesia pictipes *Grt. & Rob.*

Pyralidae

Pantographa limata *Grt. & Rob.*
Evergestis straminalis *Hübn.*
*Nomophila noctuella *D. & S.*
*Phlyctaenia terrealis *Treit.*
P. tertialis *Guen.*
Pyrausta pertextalis *Lede.*
P. aeglealis *Walk.*
P. thestealis *Walk.*
*P. theseusalis *Walk.*
P. orphisalis *Walk.*
P. unifascialis *Pack.*
P. phoenicealis *Hübn.*
Pyralis cuprina *Zell.*
Galasa rubidana *Walk.*
Crambus agitatellus *Clem.*
C. hortuellus *Hübn.*
C. mutabilis *Clem.*
Benta asperatella *Clem.*
Mineola tricolorella *Grote*
Tlascala finitella *Walk.*
Salebria basilaris *Zell.*

Pterophoridae

Pterophorus homodactylus *Walk.*
P. paleaceus *Zell.*

Tortricidae

Olethreutes dimidiana *Sodof.*
*O. hemidesma *Zell.*
O. campestrana *Zell.*
*O. dealbana *Walk.*
Eucosma juncticiliana *Walsingham*
*E. dorsisignatana *Clem.*
Thiodia signatana *Clem.*
Proteoteras aesculanum *Riley*, a moffatiana *Fern.*
Sparganothis xanthoides *Walk.*
*Archips cerasivorana *Fitch*
*A. obsoletana *Walk.*
A. fervidana *Clem.*
A. virescana *Clem.*
A. persicana *Fitch*
A. melaleucana *Walk.*
Tortrix conflictana *Walk.*
T. argentana *Clerck*
Amorbia humerosana *Clem.*

Xyloryctidae

Stenoma schlaegeri *Zell.*

Oecophoridae

Machimia tentoriferella *Clem.*
Depressaria pulvipennella *Clem.*

EXPLANATION OF PLATES[1]

Plate 1

1 Wing of Mansonia titillans Walk. x21
2 Wing of Mucidus alternans Westw. x21
3 Portion of wing of Mansonia titillans Walk. x110
4 Portion of wing of Mucidus alternans Westw. x110

Plate 2

1 Wing of Aedeomyia squammipenna Arrib. x21
2 Wing of Eretmapodites quinquevittatus Theo. x21
3 Portion of wing of Aedeomyia squammipenna Arrib. x110
4 Portion of wing of Eretmapodites quinquevittatus Theo. x110

Plate 3

1 Wing of Theobaldia incidens Thom. x21
2 Wing of Sabethes remipes Wied. x21
3 Portion of wing of Theobaldia incidens Thom. x55
4 Portion of wing of Sabethes remipes Wied. x110

Plate 4

1 Male genitalia of Cellia albipes Theo. x110
2 Male genitalia of Cycloleppteron grabhamii Theo. x110

Plate 5

1 Male genitalia of Pyretophorus costalis Loew x110
2 Male genitalia of Janthinosoma lutzii Theo. x110

Plate 6

1 Male genitalia of Grabhamia discolor Coq. x110
2 Male genitalia of Desvoidea panalectros Theo. x110

Plate 7

1 Male genitalia of Mucidus alternans Westw. x80
2 Male genitalia of Culicada subcantans, n.sp. x65

[1]Reproduces from photomicrographs by the author and J. R. Gillett.

Plate 8

1 Male genitalia of Culicada cantans Meig. x65
2 Male genitalia of Culicada fitchii Felt x65

Plate 9

1 Male genitalia of Culicada abfitchii Felt x80
2 Male genitalia of Culicada confirmatus Theo. x110

Plate 10

1 Male genitalia of Culicada curriei Coq. x110
2 Male genitalia of Culicada pullatus Coq. x110

Plate 11

1 Male genitalia of Culicada abserratus Felt & Young x80
2 Male genitalia of Culicada dupreei Coq. x110

Plate 12

1 Male genitalia of Theobaldia incidens Thom. x110
2 Male genitalia of Theobaldia annulata Meig. x110

Plate 13

1 Male genitalia in part of Theobaldia spathipalpis Rond. x80
2 Male genitalia in part of Culex diversus Theo. x80

Plate 14

1 Male genitalia of Culex viridiventer Giles x110
2 Male genitalia in part of Culex pulcriventer Giles x110

Plate 15

1 Male genitalia of Melanoconion atrata Theo. x110
2 Male genitalia of Taeniorhynchus perturbans Walk. x110

Plate 16

1 Male genitalia of Taeniorhynchus brevicellulus Theo. x80
2 Male genitalia of Taeniorhynchus aurites Theo. x80

Plate 17

1 Male genitalia of Stegomyia fasciata Fabr. x110
2 Male genitalia of Pneumaculex signifer Coq. x110

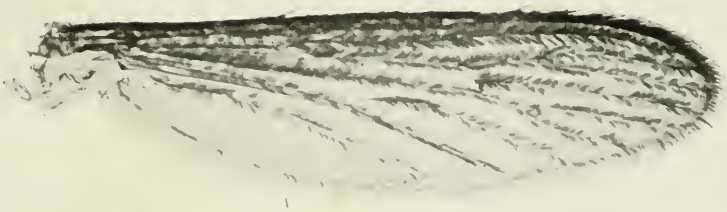
Plate 18

1 Male genitalia of Protoculex serratus Theo. x110
2 Male genitalia of Aedes fuscus O.S. x110

Plate 19

1 Male genitalia of Megarhinus portoricensis Von Roder x80
2 Male genitalia of Corethrella brakeleyi Coq. x240

Plate 1



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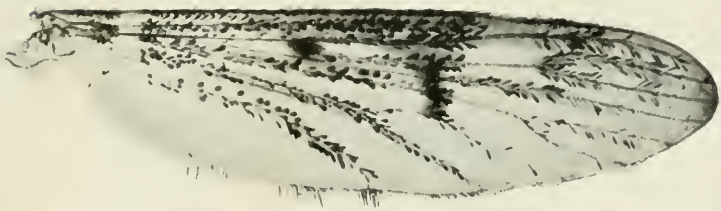

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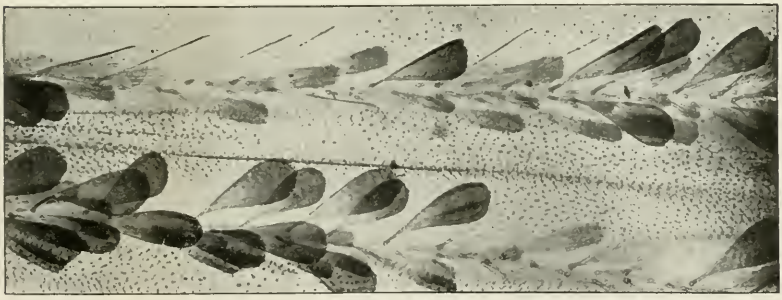
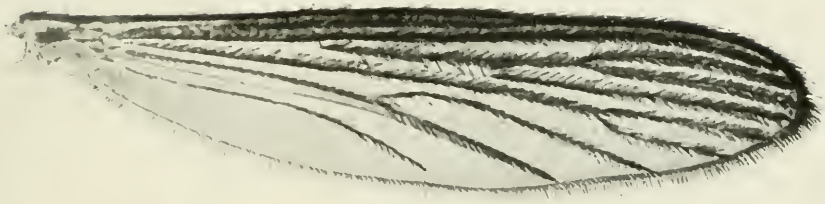


4

1, 3 Mansonia titillans. 2, 4 Mucidus alternans

Plate 2

1



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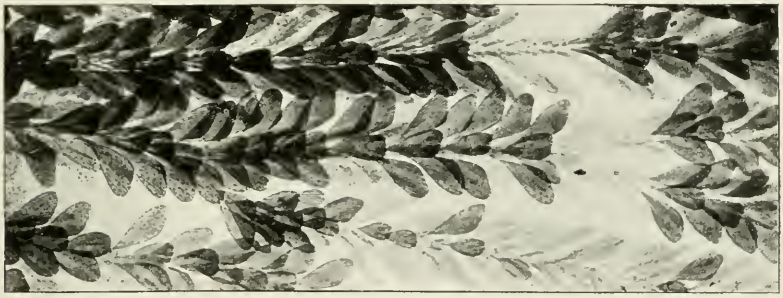

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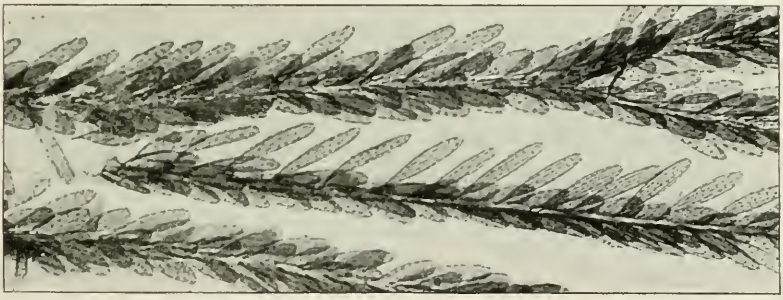
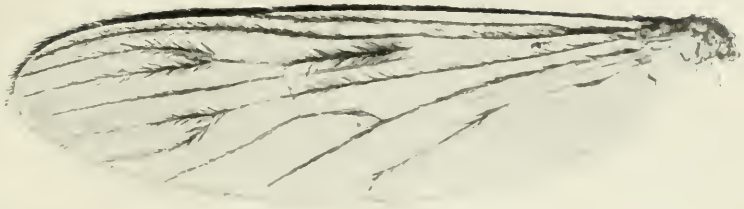


4

1, 3 Aedeomyia squammipenna. 2, 4 Eretmapodites quinquevittatus

Plate 3



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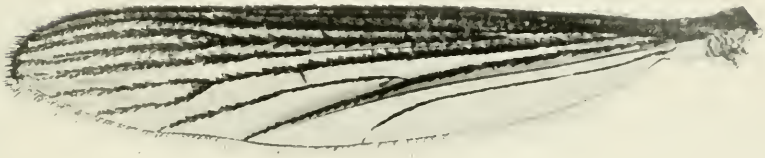

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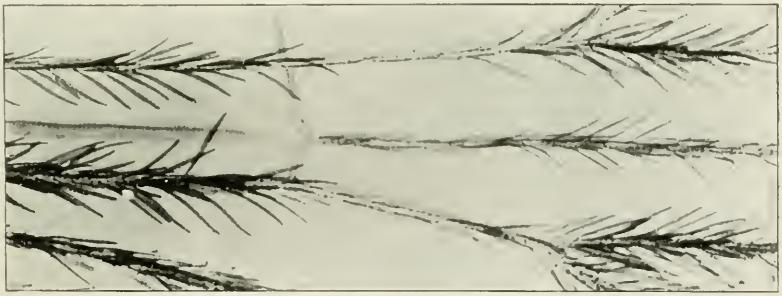

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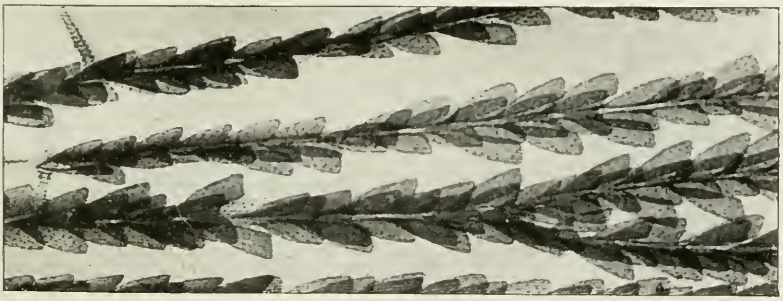


4

1, 3 Theobaldia incidens. 2, 4 Sabethes remipes

Plate 4

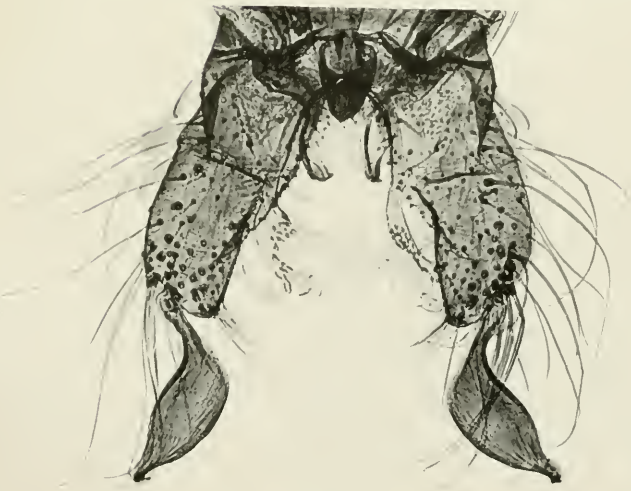
1

2

1 Cellia albipes. 2 Cycloleppteron grabhamii

Plate 5

1

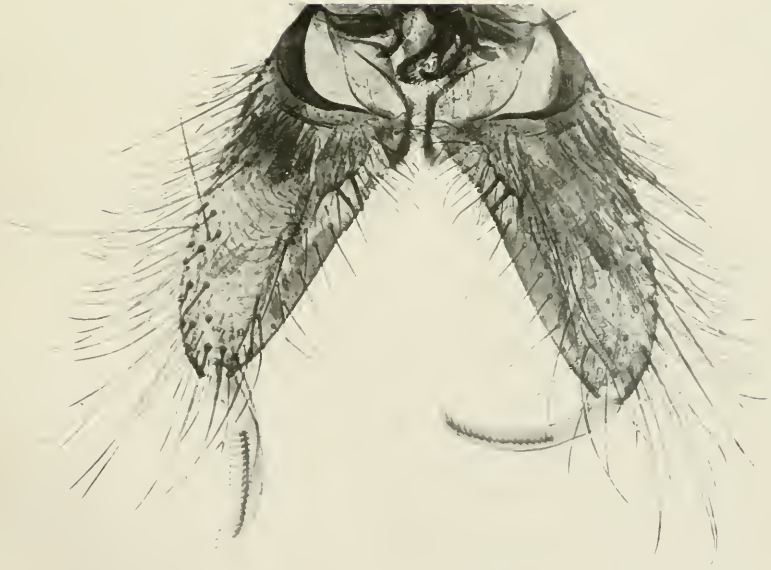


2

1 Pyretophorus costalis. 2 Janthinosoma lutzii

Plate 6

1



2

1 Grabhamia discolor. Desvoidea panalectros

Plate 7

1

2

1 Mucidus alternans Culicada subcantans

Plate 8

1

2

1 Culicada cantans. 2 C. fitchii

Plate 9

1

2

1 Culicada abfitchii. 2 C. confirmatus

Plate 10

1

2

1 Culicada currei. 2 C. pullatus

Plate 11

1

2

1 Culicada abserratus. 2 C. dupreei

1

2

1 Theobaldia incidens. 2 T. annulata

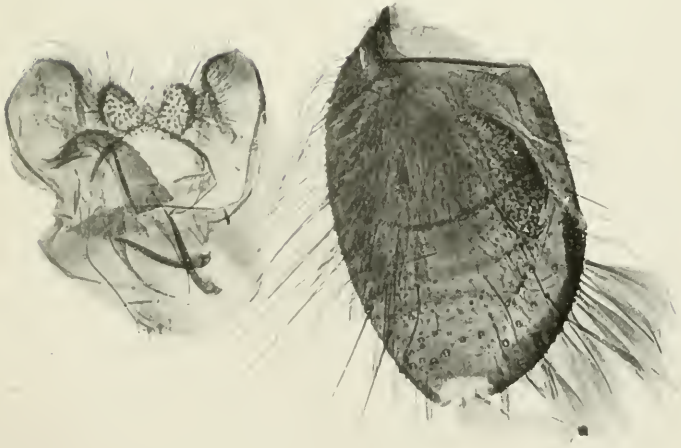
Plate 13

1 2

1 Theobaldia spathipalpis. 2 Culex diversus

Plate 14

1



2

1 Culex viridiventer. 2 C. pulcriventer

Plate 15

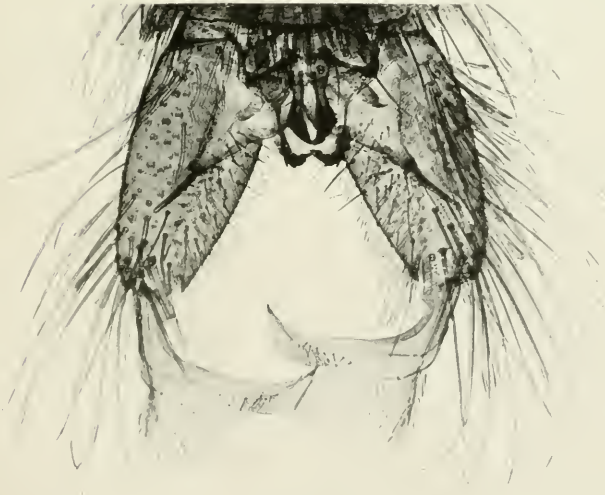
1

2

1 Melanoconion atrata. 2 Taeniorhynchus perturbans

Plate 16

1



2

1 Taeniorhynchus brevicellulus. 2 T. aurites

Plate 17

1

2

1 Stegomyia fasciata. 2 Pneumaculex signifer

Plate 18

1

2

1 Protoculex serratus. 2 Aedes fuscus

Plate 19

1

2

1 Megarhinus portoricensis 2 Corethrella brakeleyi

INDEX

The superior figures tell the exact place on the page in ninths; e. g. 363^3 means page 363, beginning in the third ninth of the page, i. e. about one third of the way down.

abbas, A adus, 549^9.
abbrevia us, Phlegyas, 549^4.
abfitchii, Culex, 451^8, 451^9.
abfitchii, Culicada, *see* Culicada abfitchii.
abietis, Athysanus, 501^9.
abserratus, Culex, 425^6.
abserratus, Culicada, *see* Culicada abserratus.
absinthiata, Tephroclystis, 560^5.
absobrinus, Culiseta, 448^3, 466^4, 481^3.
Acanthosoma cruciata, 549^1.
  lateralis, 549^1.
Acarina, contributions of, 431^6.
Acknowledgments, 363^3.
Acocephalinae, 501^2.
Acocephalus, 501^3, 514^8–15^5.
  albifrons, 515^3.
  flavostriatus, 515^1.
  flavostrigatus, 515^1.
  mixtus, 515^3.
  nervosus, 514^9.
  rivularis, 515^1.
  striatus, 514^8.
  vitellinus, 516^4.
Acopsis viridis, 511^4.
Acorn weevil, 420^1.
Actinotia ramosula, 558^7.
acuminata, Cicada, 512^4.
acuminata, Thelia, 420^1.
acuminatus, Eucanthus, 512^3, 553^9.
acuta, Tettigonia, 511^3.
acuticauda, Athysanella, 529^6, 555^5.
acutus, Jassus, 516^7.
acutus, Platymetopius, 516^7, 554^7.
Adalia bipunctata, 418^4.
Adelphagrotis prasina, 558^8.
Adirondack insects, 436^7–38^8.
adjuncta, Mamestra, 559^4.
Aedeomyia squammipenna, 462^4.
  explanation of plate, 562^3.
Aedeomyinae, 491^1–94^3.
Aedes fuscus, 447^7, 451^8, 451^9, 491^2, 492^7–93^2.
  explanation of plate, 564^2.
  figure, 465.
aesculanum, Proteoteras, 561^6.
aeglealis, Pyrausta, 561^3.
aemula, Epizeuxis, 559^6.
aeneifrons, Homoemus, 546^9, 548^3.
aerea, Plusia, 559^2.
aeroides, Plusia, 559^2.
affinis, Deltocephalus, 522^6.
affinis, Miris, 550^8.
Agallia, 500^8, 508^2.
  constricta, 508^8.
  4-punctata, 508^2, 554^6.
  novella, 508^7, 554^6.
  novellus, 508^7.
  sanguinolenta, 508^4, 554^6.
  siccifolia, 508^5.
Agapetidae, 557^6.
agilis, Dicyphus, 551^9.
agitatellus, Crambus, 561^3.
Aglais milberti, 557^5.
agrestis, Cicada, 514^6.
agrestis, Selenocephalus, 514^7.
agrestis, Strongylocephalus, 514^6.
Agrotis astricta, 558^9.
  geniculata, 558^9.
  messoria, 407^4.
  ypsilon, 558^9.
alabastaria, Synelys, 560^8.
Alaus oculatus, 409^1, 423^5.
albifrons, Acocephalus, 515^3.
albifrons, Symmerista, 559^9.
albilinea, Heliophila, 559^5.
albipes, Cellia, *see* Cellia albipes.
albipes, Sayomyia, 497^4.
alboneura, Empoasca, 543^5.
albopicta, Empoasca, 543^2.
albopunctatus, Platymetopius, 517^7.

albosigma, Melalopha, *see* Melalopha albosigma.
albostriella, Alebra, 541[7].
albostriella, Cicada, 541[8].
albostriella, Typhlocyba, 541[8].
albostriella fulveola, Alebra, 541[9].
albovenosa, Arsilonche, 558[7].
albovittata, Euchoeca, 560[5]
Alder, insects injurious to:
Bythoscopus pruni, 554[2].
Ceresa turbida, 552[6].
Pediopsis canadensis, 554[3].
Alebra, 501[6], 541[7].
albostriella, 541[7].
fulveola, 541[9].
aurea, 541[8].
binotata, 541[8].
fumida, 542[1].
pallida, 541[8].
Alexander, O. A. mentioned, 407[9].
Allygus irroratus, 533[5].
alope, Cercyonis, 557[6].
alternans, Mucidus, *see* Mucidus alternans.
alternata, Rhynchagrotis, 558[8].
alternatus, Bythoscopus, 506[4].
alternatus, Idiocerus, 506[4], 554[5].
alutacea, Magdalis, 419[5].
Alypia octomaculata, 416[8].
Amblycephalus inimicus, 523[3].
melsheimeri, 521[7].
sayi, 519[6].
Amblyscirtes samoset, 557[9].
vialis, 557[8].
Ambrostola urentis, 559[4].
americalis, Epizeuxis, 559[6].
americana, Apatela, 558[7].
americana, Gortyna, 559[7].
americana, Malacosoma, *see* Malacosoma americana.
americana, Microvelia, 550[1].
americana, Penthimia, 514[3].
americana, Schizoneura, 406[1].
americanus, Necrophorus, 425[4].
americanus, Pytho, 419[4].
amicaria, Hyperitis, 560[7].
amorata, Calizzia, 561[1].
Amorbia humerosana, 561[6].
Ampelophaga choerilus, 558[1].
ampla, Autographa, 559[3].
Anasa tristis, 413[8].
ancetaria, Azelina, 560[9].
anchocelioides, Rhynchagrotis, 558[8].
angulalis, Palthis, 559[8].
angulifera, Diedrocephala, 511[6].
angulifera, Draeculacephala, 511[6].
angulifera, Tettigonia, 511[6].
angustatus, Cymus, 549[5].
angustatus, Nysius, 549[3].
angustatus, Platymetopius, 518[4].
Ania limbata, 560[8].
Anisota senatoria, 419[9].
Annemoria bistriaria, 560[9].
annulata, Theobaldia, *see* Theobaldia annulata.
annulicornis, Compsocerocoris, 551[1].
annulifera, Culicada, 476[5].
annulioris, Culex, 465[6], 485[1].
annulirostris, Culex, 484[7].
Anomala lucicola, 419[6].
Anomia ulmi, 545[7].
Anopheles barberi, 449[5].
crucians, 449[6].
franciscanus, 449[7].
maculipennis, 449[6], 470[1].
punctipennis, 420[8], 449[7], 469[8]–70[1].
Anophelinae, 469[1]–71[4].
Anosia plexippus, 557[7].
Anthocoridae, 550[6].
Anthocoris *sp.*, 550[6].
musculus, 550[6].
Anthomaster leonardus, 557[9].
anthracinus, Athysanus, 528[2], 555[4].
antica, Tettigonia, 511[3].
antiopa, Euvanessa, 557[5].
antiqua, Notolophus, 560[2].
Ants, 425[6]; in lawn, 422[4].
large black carpenter, 419[9].
white, 419[4].
Apaecasia defluata, 560[5].
apamiformis, Hadena, 558[9].
Apantesis arge, 558[5].
intermedia, 558[5].
parthenice, 558[5].
virgo, 558[5].
Apatela americana, 558[7].
dactylina, 558[7].
fragilis, 558[7].
hamamelis, 558[7].
impressa, 558[7].
interrupta, 558[7].
morula, 558[7].

apertus, Phlepsius, 532[6], 555[6].
Aphis mali, 416[4], 422[2].
aphrodite, Argynnis, 557[5].
Aphrophora 4-notata, 553[5].
parallela, 419[6].
quadrangularis, 419[6].
saratogensis, 419[6].
apicatus, Deltocephalus, 520[3], 555[2].
apterus, Halticus, 551[8].
Apple aphid, 422[2].
Apple caterpillar, red-humped, 403[7]–4[5], 425[8].
Apple leaf miners, fall, 404[5]–5[5], 425[8].
Appletree, insects injurious to:
Lithocolletes blancardella, 404[7].
Ornix geminatella, 404[6].
Paleacrita vernata, 418[6].
plant lice, 412[2].
Schizoneura lanigera, 414[9].
Tischeria malifoliella, 404[9].
Appletree bark louse, 421[1], 421[4].
Appletree tent caterpillar, 412[9], 413[5], 414[4], 414[6], 416[6], 417[5], 418[2], 4[8]5.
Aquatic insects, studies on, 3[6]8.
Aradidae, 549[8].
Aradus abbas, 549[9].
4–lineatus, 549[8].
niger, 549[8].
Arbor vitae, insects injurious to, 419[9].
Archasia galeata, 420[1].
archippus, Basilarchia, 557[6].
Archips cerasivorana, 561[5].
fervidana, 561[5].
melaleucana, 561[6].
obsoletana, 561[5].
persicana, 561[5].
virescana, 561[5].
Arctia caia, 558[5].
caia a, americana, 558[5].
arctica, Hadena, 558[6].
Arctiidae, 558[5].
arcuata, Drepana, 560[3].
areolatus, Deltocephalus, 520[6].
arge, Apantesis, 55.8[5]
argentana, Tortrix, 561[6].
Argynnis aphrodite, 557[5].
atlantis, 557[5].
cybele, 557[5].
Arsenate of lead, 404[4].
Arsenical poison, 386[8], 406[6]; experiments with, 371[7]–80[7].
Arsilonche albovenosa, 558[7].
arthemis, Basilarchia, 557[6].
Ashes, 406[9].
asparagi, Crioceris, 414[1], 422[2].
Asparagus beetle, 414[1], 422[2].
asperatella, Benta, 561[3].
Aspidiotus perniciosus, 360[4], 386[9]–403[3], 416[6], 417[2], 419[2], 421[1], 421[4], 421[5], 422[1], 422[2], 424[3], 425[1], 425[2], 425[3], 425[5].
asteroides, Cucullia, 559[7].
astricta, Agrotis, 558[9].
astylusaria, Euchlaena, 560[8].
atalanta, Vanessa, 557[5].
Athysanella, 501[4], 529[6].
acuticauda, 529[6], 555[5].
Athysanus, 501[4].
sp., 555[1].
abietis, 501[9].
anthracinus, 528[2], 555[4].
curtisii, 529[1], 555[4].
extrusus, 527[5], 555[3].
fagi, 504[3].
fenestratus, 503[3].
galbanatus, 538[9].
gammaroidea, 529[4].
instabilis, 528[6].
nigrinasi, 503[9].
obsoletus, 526[6].
osborni, 527[9].
plutonius, 528[4], 555[3].
seminudus, 530[1].
simplarius, 528[1].
striatulus, 528[5], 528[6], 528[7].
striola, 527[6].
tergatus, 538[5].
unicolor, 538[3].
vaccinii, 528[7], 555[3].
variabilis, 501[8].
venosus, 526[7]–27[5], 555[2].
figure, 527.
viridius, 538[7].
atlantis, Argynnis, 557[5].
atrata, Melaniconion, *see* Melaniconion atrata.
atrolabes, Empoasca, 542[9], 556[4].
atropalpus, Culicada, 448[4], 449[3], 477[7].
Atrytone hobomok, 557[9].

Aulacizes, 500[9], 509[5].
guttata, 509[6].
irrorata, 509[5].
lineata, 511[4].
novaeboracensis, 511[8].
pollinosa, 509[6].
rufiventris, 509[6].
aurantiaca, Eubaphe, 558[5].
aurata pallida, Typhlocyba, 541[8].
aurea, Alebra, 541[8].
aurifer, Culicelsa, 448[9], 449[9], 473[8]–74[1].
aurites, Taeniorhynchus, *see* Taeniorhynchus aurites.
auroides, Culicelsa, 448[1], 449[9]–51[5].
auronitens, Scaphoideus, 524[4].
Autographa ampla, 559[3].
bimaculata, 559[3].
falcigera, 559[3].
a. simplex, 559[3].
octoscripta, 559[3].
precationis, 559[3].
rectangula, 559[3].
u-aureum, 559[3].
Automeris io, 558[3].
Azelina ancetaria, 560[9].

Baileya ophthalmica, 558[8].
Balaninus nasicus, 420[2].
Balfour, Andrew, acknowledgments to, 443[4].
Ball, E. D., cited, 499[7], 507[7], 508[9], 510[2], 520[2], 522[9], 523[1], 528[3], 528[7], 553[8], 554[3].
balli, Chlorotettix, 539[1].
balluca, Plusia, 559[2].
Balsa malana, 558[8].
Balsam, insects injurious to, 419[9].
Ceresa bubalus, 407[9].
Phlepsius fulvidorsum, 555[6].
balsameus, Tomicus, 419[9].
balteatus, Ligyrocoris, 549[6].
Barber, H. G., mentioned, 510[7], 512[8], 523[7], 524[5], 528[3], 532[4], 538[8]; cited, 515[5], 525[3], 525[5].
barberi, Anopheles, 449[5].
Bark beetle, coarse writing, 419[3].
pine, 419[4].
turpentine, 419[3].
Bark borer, balsam, 419[9].
spruce, 419[8].
Bark louse, scurfy, 421[6].
basalis, Pediopsis, 505[4], 554[3].
Basilarchia archippus, 557[6].
arthemis, 557[6].
basilaris, Salebria, 561[4].
Basilona imperialis, 419[6].
basitriens, Notodonta, 559[9].
batatus, Neuroterus, 425[7].
batesii, Phyciodes, 557[6].
Beans, potato beetles injuring, 415[4].
Beech, Jassus olitorius injuring, 539[6].
Bees, destroying, 420[7].
driving away, 423[6].
Beetle catchers, 423[7].
belfragei, Protenor, 549[2].
belli, Jassus, 534[4].
belli, Thamnotettix, 534[1].
bellona, Brenthis, 557[5].
Beneficial insects, 411[5].
Benta asperatella, 561[3].
Beutenmuller, W., acknowledgments to, 557[3].
bicarnea, Noctua, 559[1].
bicolor, Lexis, 558[4].
bicolorago, Orthosia, 559[1].
bifasciata, Pediopsis, 504[9]–5[2].
bifida, Tettigonia, 509[8].
bimaculata, Autographa, 559[3].
binotata, Alebra, 541[8].
binotata, Enchenopa, 420[1].
binotata, Hadena, 558[9].
binotata, Typhlocyba, 541[8].
Biorhiza forticornis, 420[1].
bipunctata, Adalia, 418[4].
bipunctulata, Gypona, 513[2], 513[4].
Birch, insects injurious to:
Bythoscopus pruni, 554[2].
Idiocerus suturalis, 506[8].
birdii, Empoasca, 543[4].
bistriaria, Annemoria, 560[9].
bistriaris, Parallelia, 559[6].
biundata, Heterocampa, 559[9].
bivittatus, Xyloterus, 419[4].
Blackberry bushes, insects injurious to:
Aphis mali, 416[7].
Diedrocephala coccinea, 511[1].
blancardella, Lithocolletes, 404[7], 425[9].

Blister beetle, black, 418[1].
Bomolocha deceptalis, 559[8].
scutellaris, 559[8].
Bordeaux mixture, 396[3], 399[2], 406[8].
botrana, Polychrosis, 418[9].
Box elder, insects injurious to:
Chaitophorus negundinis, 414[7].
plant lice, 415[5].
Brakeley, J. Turner, acknowledgments to, 443[6]; mentioned, 450[7].
brakeleyi, Corethrella, *see* Corethrella brakeleyi.
Bran mash, poisoned, 407[7].
brassicae, Pegomyia, 422[2].
brassicae, Phorbia, 413[8].
Brenthis bellona, 557[5].
myrina, 557[5].
brevicellulus, Taeniorhynchus, *see* Taeniorhynchus brevicellulus.
breviusculus, Phytocoris, 551[1].
Britton, W. E., acknowledgments to, 443[5].
Brotolomia iris, 559[8].
Brown, A. N., mentioned, 399[7].
Brown tail moth, 385[3]–86[8]; description and habits, 385[7]–86[7]; remedies, 386[7].
Bruchomorpha oculata, 553[4].
brunneipennis, Rhynchagrotis, 558[8].
brunneus, Eutettix, *see* Eutettix brunneus.
bubalus, Ceresa, 407[8]–8[1].
Buck moth, 419[9].
Bud moth, 418[5].
Bueno, J. R. de la Torre, acknowledgments to, 499[5]; cited, 511[5], 513[1], 513[3], 528[5], 532[8], 533[5], 539[6]; mentioned, 512[7], 512[8], 520[7], 529[8], 531[9], 533[7].
Buenoa platycnemis, 552[4].
Buffalo tree hopper, 407[8]–8[1].
Bythoscopidae, 500[6], 500[8], 501[7]–8[9], 554[1].
Bythoscopus, 500[8], 501[7].
alternatus, 506[4].
clitellarius, 507[8].
cognatus, 503[1], 554[1].
distinctus, 504[2].
fagi, 504[3].
fenestratus, 503[3].
Bythoscopus (*continued*)
4-punctatus, 508[2].
lachrymalis, 507[3].
maculipennis, 507[6].
minor, 503[7], 554[1].
nigrinasi, 503[9]–4[1].
pallidus, 505[9].
pruni, 503[5], 554[2].
sanguinolentus, 508[4].
seminudus, 529[9].
siccifolius, 508[4].
sobrius, 502[2].
strobi, 531[4].
suturalis, 506[7].
tergatus, 538[5].
trimaculata, 504[5].
unicolor, 538[2].
variabilis, 501[8]–2[2], 502[8].
verticis, 507[9].

c-nigrum, Noctua, 559[1].
Cabbage, insects injurious to:
Agrotis messoria, 407[4].
cutworm, 413[4].
Cabbage butterfly, 412[9], 413[4], 416[8], 417[1], 418[3].
Cabbage maggot, 413[8], 422[2].
Cabbage worm, 424[4].
Caberodes confusaria, 560[9].
majoraria, 560[9].
Cacoecia fervidana, 419[9].
cacographus, Tomicus, 419[3].
caelatus, Tomicus, 419[4].
caeruleocinctus, Julus, 422[9], 423[7].
caia, Arctia, 558[5].
a. americana, Arctia, 558[5].
Calizzia amorata, 561[1].
calligraphus, Tomicus, 419[3].
Callipterus ulmifolii, 415[3], 417[8].
Calocampa curvimacula, 559[7].
Calocoris rapidus, 551[2].
tinctus, 551[2].
Calpe canadensis, 559[2].
cambrica, Venusia, 560[5].
campestrana, Olethreutes, 561[5].
campestris, Liburnia, 553[3].
Camponotus herculaneus, 419[9].
Camptobrochis grandis, 551[5].
nebulosus, 551[6].
Campylenchia curvata, 552[6].
cana, Gypona, 512[9].

canadaria, Melanolophia, 560[6].
canadensis, Calpe, 559[2].
canadensis, Culicada, 448[6], 454[8], 474[2].
canadensis, Emphytus, 406[4].
canadensis, Pediopsis, 504[8], 554[3].
cancer, Deinocerites, *see* Deinocerites cancer.
caniplaga, Ellida, 559[9].
Cankerworms, 416[1], 418[5].
cantans, Culex, 451[9], 475[3].
cantans, Culicada, 474[3]–75[2], 563[1].
cantator, Culicada, 448[8], 476[9]–77[2].
Capsidae, 550[7]–52[4].
Caradrina miranda, 558[8].
Carbon bisulfid, 410[3], 425[6].
cardui, Vanessa, 557[6].
Carex vulpinoidea, Xestocephalus pulicarius injuring, 515[6].
carinatus, Scaphoideus, 525[3].
Caripeta divisata, 560[5].
carneola, Eustrotia, 559[4].
carnifex, Cosmopepla, 548[3].
Carpocapsa pomonella, 422[2].
Carrion beetles, 425[4].
Carsia paludata, 560[4].
Carynota marmorata, 552[7].
Caterpillar, false, 425[7].
Catocala cerogama, 559[6].
coccinata, 559[6].
a. sinuosa, 559[6].
concumbens, 559[5].
relicta, 559[5].
unijuga, 559[5].
Cattaraugus county, summary of voluntary reports from, 412[7]–13[4].
Caustic soda solution, 395[6]–96[2], 399[2].
Cayuga county, summary of voluntary reports from, 413[4].
Cecidomyia hirtipes, 410[4]–11[4].
persicoides, 425[8].
Cedar bushes, insects injurious to: Dichrooscytus elegans, 552[2].
Cellia albipes, 449[6], 469[5], 470[4].
explanation of plate, 562[6].
Centipede, house, 424[3].
ceparum, Phorbia, 418[3].
cerasi, Myzus, 414[7], 422[2].
cerasifex, Lecanium, 412[8].
cerasivorana, Archips, 561[5].
Ceratomia undulosa, 558[1].
Cercopidae, 553[5].
Cercopis viridis, 512[5].
Cercyonis alope, 557[6].
Ceresa bubalus, 407[8]–8[1].
diceros, 552[7].
melanogaster, 552[7].
turbida, 552[6].
cerintha, Chamyris, 559[4].
cernes, Thymelicus, 557[9].
cerogama, Catocala, 559[6].
cerysii, Smerinthus, 558[2].
Chaitophorus negundinis, 414[8].
Chamyris cerintha, 559[4].
Chautauqua grape belt, 423[1].
Chermes, pine bark, 419[5].
Chermes pinicorticis, 419[6].
Cherry aphis, 422[2].
Cherry fruit fly, 416[4].
Cherry scale, 412[7].
Cherrytree, Schizura concinna injuring, 404[4].
chersis, Sphinx, 558[1].
Chilocorus similis, 360[5], 411[5].
Chinese lady beetle, 360[5], 411[5].
Chionaspis furfura, 421[6].
pinifoliae, 419[7].
Chlamydatus pulicarius, 552[3].
chlorionis, Orthotylus, 552[2].
Chlorita flavescens, 543[3].
Chlorotettix, 501[5], 538[2].
balli, 539[1].
galbanata, 538[8].
lusoria, 539[2], 556[1].
tergata, 538[4], 555[9].
unicolor, 538[2], 555[9].
viridia, 538[7]. 555[9].
choerilus, Ampelophaga, 558 .
Chrysobothris dentipes, 419[7].
floricola, 419[7].
pusilla, 419[7].
Chrysomela, pine, 419[6].
Chrysophanus thoe, 557[8].
chrysorrhoea, Euproctis, 385[3]–86[8].
Chytolita petrealis, 559[7].
Chytonix palliatricula, 558[8].
Cicada, dog day, 420[1].

Cicada acuminata, 512[4].
agrestis, 514[6].
albostriella, 541[8].
coccinea, 510[8].
costalis, 509[3].
flavescens, 543[3].
irrorata, 509[5].
lateralis, 509[3].
marginella, 509[3].
nigripennis, 509[5].
punctata, 541[2].
punctifrons, 540[7].
rosae, 545[8].
6-notata, 539[9].
smaragdula, 542[7].
striatula, 528[5].
striola, 527[7].
tibicen, 420[1].
ulmi, 545[7].
variata, 540[4].
Cicadula, 501[6].
4-punctata, 535[9].
lepida, 540[9].
macgillivray, 541[1].
punctifrons, 540[7].
var. americana, 540[6].
6-notata, 539[8]–40[2], 556[1].
slossoni, 540[2], 556[2].
variata, 540[4], 556[2].
ciliata, Psorophora, 448[2], 471[5].
cincta, Eutettix, 530[3].
cinctipes, Corethra ,451[8], 454[8], 496[4].
cinctus, Sehirus, 548[5].
cinereoborealis, Culex, 425[6], 451[9].
Cinglis purata, 560[8].
cingulata, Rhagoletis, 416[4].
Cissia eurytus, 557[7].
Cixius coloepium, 552[9].
stigmatus, 552[9].
clandestina, Noctua, 559[2].
Clastoptera obtusa, 553[6].
proteus, 553[6].
claviculus, Cymus, 549[5].
clavipes, Pilophorus, 551[7].
Cleora indicataria, 560[5].
larvaria, 560[6].
pampinaria, 560[6].
clitellarius, Bythoscopus, 507[8].
clitellarius, Jassus, 534[7].
clitellarius, Thamnotettix, 534[6], 555[7].
Clover, Nectarophora pisi, injuring, 408[3].
coccinata, Catocala, 559[6].
a. sinuosa, Catocala, 559[6].
coccinea, Cicada, 510[8].
coccinea, Diedrocephala, 510[8], 553[7].
coccinea, Empoa, 544[5].
coccinea, Typhlocyba, 544[5].
Cockscomb elm gall, 424[2].
Codling moth, 422[2].
Coelidia olitaria, 539[4].
subbifasciata, 539[5].
Coenocalpe magnoliata, 560[7].
Coenus delius, 548[7].
cognataria, Glena, 560[6].
cognataria, Lycia, 560[6].
cognatus, Bythoscopus, 503[1], 554[1].
Coleoptera, contributions of, 426[6]–27[6].
Collaria meilleuri, 550[8].
collaris, Noctua, 559[2].
Collections of insects, 361[7]–62[6]; contributions to, 426[4]–31[8].
coloepium, Cixius, 552[9].
Colopha ulmicola, 424[2].
Colorado potato beetle, 416[3], 417[2].
comes, Typhlocyba, 545[2].
comes *var.* basilaris, Typhlocyba, 545[4].
comes *var.* vitis, Typhlocyba, 545[4].
comma, Polygonia, 557[6].
commoides, Heliophila, 559[6].
communis, Dicraneura, 542[3], 556[3].
communis, Helochara, 512[1], 553[9].
compactus, Deltocephalus, 521[1], 555[1].
Compsocerocoris annulicornis, 551[1].
Comstock, G. F., acknowledgments to, 499[4]; List of Lepidoptera Taken at Keene Valley N. Y., 557[1]–61[7].
comstockiana, Retinia, *see* Evetria.
comyntas, Everes, 557[8].
concinna, Schizura, 403[7]–4[5], 425[8].
concolor, Culex, *see* Culex concolor.
concumbens, Catocala, 559[5].
configuratus, Deltocephalus, 521[5], 554[8].
confirmatus, Culicada, 476[7], 563[2].
conflictana, Tortrix, 561[6].
confusa, Haploa, 558[5].
confusaria, Caberodes, 560[9].

confusor, Monohammus, 419[4], 424[4].
congrex, Diommatus, 550[9].
consobrina, Empoasca, 543[6].
consobrinus, Culiseta, 448[4], 466[4], 481[6].
consors, Scaphoideus, 523[6].
constricta, Agallia, 508[8].
constricta, Ligyrocoris, 549[7].
contexta, Euchalcia, 559[3].
contracta, Ligyrocoris, 549[6].
convexipennis, Cucullia, 559[7].
Coquillett, acknowledgments to, 363[4].
Coreidae, 549[2].
Corethra, 446[8].
  cinctipes, 451[8], 454[8], 496[4].
  fuliginosus, 458[3], 496[9].
  karnerensis, 451[8], 454[8], 496[7].
  lintneri, 496[6].
Corethrella brakeleyi, 446[8], 496[2].
  explanation of plate, 564[3].
  figures, 460, 494, 495.
Corethrinae, 494[4]–97[6].
Coriscus ferus, 550[3].
  inscriptus, 550[3].
  rufusculus, 550[3].
  subcoleoptratus, 550[4].
  vicarius, 550[4].
Corixa *sp.*, 552[5].
Corixidae, 552[5].
Corizus nigristernum, 549[3].
  novaeboracensis, 549[2].
Corn, insects injurious to:
  Agrotis messoria, 407[4].
  Papaipema nitela, 407[1], 417[7].
Correspondence during year, 360[2].
Corythuca juglandis, 549[7].
Cosmia paleacea, 559[1].
Cosmopepla carnifex, 548[8].
costalis, Cicada, 509[3].
costalis, Oncometopia, 546[9], 553[6].
costalis, Pyretophorus, *see* Pyretophorus costalis.
Cottonwood, Pediopsis bifasciata injuring, 505[2].
Crambus agitatellus, 561[3].
  hortuellus, 561[3].
  mutabilis, 561[3].
crataegi, Idiocerus, 507[2].
crenulata, Orthodes, 559[6].
Crepidodera cucumeris, 406[7], 413[1], 414[8], 417[9].
crepuscularia, Ectropis, 560[6].
Cressonia juglandis, 558[2].
Cricket, white flower, 421[8].
Crioceris asparagi, 414[1], 422[2].
crocallata, Tetracis, 560[9].
crocataria, Xanthotype, 560[7].
croseipes, Stiphrosoma, 551[8].
crucians, Anopheles, 449[6].
cruciata, Acanthosoma, 549[1].
cruentata, Dicraneura, 542[2].
Cryphalus striatulus, 419[8].
Ctenucha virginica, 558[4].
Cucullia asteroides, 559[7].
  convexipennis, 559[7].
  intermedia, 559[7].
Cucumber beetle, striped, 412[1], 413[3], 413[7], 414[1], 414[8], 415[4], 418[3].
Cucumber flea beetle, 406[7].
cucumeris, Crepidodera, *see* Crepidodera cucumeris.
Culex, 482[3]–87[6].
  abfitchii, 451[8], 451[9].
  abserratus, 425[6].
  annulioris, 465[6], 485[1].
    figure, 485.
  annulirostris, 484[7].
  cantans, 451[9], 475[3].
  cinereoborealis, 425[6], 451[9].
  concolor, 465[6], 485[8]–86[5].
    figure, 486.
  cylindricus, 484[6].
  diversus, 481[9]–82[3].
    explanation of plate, 563[6].
  fatigans, 483[4].
  fitchii, 425[6], 451[6]–54[1].
  impiger, 451[8].
  lazarensis, 425[6].
  pipiens, 446[2], 483[1].
  pulcriventer, 487[1].
    explanation of plate, 563[7].
  restuans, 446[1], 483[6].
  salinarius, 445[8].
  secutor, 446[3].
  subcantans, 451[8].
  tarsalis, 446[2], 484[2].
  territans, 445[8], 483[9]–84[2].
  tigripes, 465[6], 485[5].
    figure, 485.
  trichurus, 451[8].
  viridiventer, 486[5].
    figures, 486, 487.
    explanation of plate, 563[7].

Culicada abfitchii, 446[4], 452[1], 454[2]–56[6], 475[9]–76[4].
explanation of plate, 563[2].
abserratus, 447[2], 456[7]–58[2], 467[4]–68[4], 479[3].
figures, 466, 467, 468.
explanation of plate, 563[4].
annulifera, 476[5].
atropalpus, 448[4], 449[3], 477[7].
canadensis, 448[6], 454[8], 474[2].
cantans, 474[8]–75[2].
explanation of plate, 563[1].
cantator, 448[8], 476[9]–77[2].
confirmatus, 476[7].
explanation of plate, 563[2].
curriei, 448[9], 477[5].
explanation of plate, 563[3].
dupreei, 447[3], 479[6].
explanation of plate, 563[4].
fitchii, 446[4], 454[5], 454[8], 475[6].
explanation of plate, 563[1].
figure, 461.
impiger, 447[8], 451[9], 454[8], 478[5].
lazarensis, 448[8], 478[8].
pullatus, 448[6], 468[4], 478[9]–79[2]
explanation of plate, 563[3].
figure, 469.
sollicitans, 449[2], 477[3].
subcantans, 448[7], 452[1], 454[2], 454[4], 454[7], 474[5].
explanation of plate, 562[9].
figure, 465.
trichurus, 444[5], 447[5], 454[8], 478[1].
triseriatus, 447[8], 477[8].
trivittatus, 447[9].
varipalpus, 447[9].
vittata, 446[5].
Culicella dyari, 445[9], 448[9], 479[9]–80[2].
melanurus, 445[9], 480[2].
Culicelsa aurifer, 448[9], 449[9], 473[8]–74[1].
auroides, 448[1], 449[9]–51[5].
taeniorhynchus, 449[1], 473[8].
Culicid larvae, importance of isolated rearings from, 425[5].
Culicidae, collections, 361[7]; genitalia, 462[8]–66[4]; hermaphrodites, 467; key, 445[6]–49[8]; larvae, 443[6]–49[8]; morphology and phylogeny, 458[8]–68[9]; studies in, 442[6]–97[6]; wings, 461[4]–62[7].
Culicinae, 271[5]–90[9].
Culiseta absobrinus, 448[3], 466[4], 481[3].
consobrinus, 448[4], 466[1], 481[6].
magnipennis, 448[1].
cuprescens, Platymetopius, 517[1].
cuprina, Pyralis, 561[2].
Currant aphis, 414[7].
Currant bushes, Typhlocyba tricincta injuring, 544[7].
Currant stem sawfly, 413[6].
Currant worms, 413[1], 413[6], 414[7], 415[3] 415[4].
curriei, Culicada, *see* Culicada curriei
curtisii, Athysanus, 529[1], 555[1].
curtisii, Deltocephalus, 529[2].
curtisii, Tettigonia, 520[1].
curvata, Campylenchia, 552[6].
curvimacula, Calocampa, 559[7].
cuspidea, Euclidia, 559[5].
custodiata, Hydriomena, 560[7].
Cutworm, 413[4].
dark-sided, 407[4], 424[2].
Cyaniris ladon, 557[8].
cybele, Argynnis, 557[5].
Cycloleppteron grabhamii, 469[3], 470[6].
explanation of plate, 562[6].
cylindricus, Culex, 484[6].
Cymatophora ribearia, 560[5].
subcessaria, 560[5].
cymatophoroides, Pseudothyatira, 560[1].
Cymus angustatus, 549[5].
claviculus, 549[5].
cyperaceus, Thamnotettix, 538[1].
Cyrtorrhinus marginatus, 550[9].

dactylina, Apatela, 558[7].
Davenport, C. B., acknowledgments to, 499[4].
dealbana, Olethreutes, 561[5].
debilis, Deltocephalus, 520[8], 554[9].
decem-lineata, Doryphora, *see* Doryphora 10-lineata.
deceptalis, Bomolocha, 559[8].
decipiens, Thamnotettix, 536[2], 555[7].
decorus, Phlepsius, 533[8].
defluata, Apaecasia, 560[5].
Deilephila gallii, 558[1].
lineata, 558[2].

Deinocerites, 491[3]–94[3].
cancer, 446[3], 491[2], 491[7]–92[7].
figures, 459, 492.
delius, Coenus, 548[7].
Deltocephalus, 501[4].
sp., 555[1].
affinis, 522[6].
apicatus, 520[3], 555[2].
areolatus, 520[6].
compactus, 521[1], 555[1].
configuratus, 521[5], 554[8].
curtisii, 529[2].
debilis, 520[8], 554[9].
flavicosta, 520[4].
flavicostatus, 520[5].
inimicus, 523[2], 523[4], 555[2].
melscheimeri, 521[7]–22[5], 522[6], 554[9].
minki, 520[1], 554[8].
nigrifrons, 522[9]–23[2].
obtectus, 521[3].
osborni, 527[9].
sayi, 519[6], 555[1].
simplex, 528[1].
sylvestris, 519[9], 554[8].
Dendroctonus terebrans, 419[3].
dentatus, Phlaeosinus, 419[9].
dentipes, Chrysobothris, 419[7].
deplanata, Salda, 550[5].
Depressaria pulvipennella, 561[7].
Dermestes lardarius, 409[8]–10[4], 424[9].
designata, Gypsochroa, 560[8].
destinata, Eustroma, 560[6].
Desvoidea obturbans, 473[1].
panalectros, 472[7].
explanation of plate, 562[8].
determinata, Metanema, 560[9].
detracta, Mamestra, 559[4].
devastatrix, Hadena, 558[6].
Diabrotica vittata, 413[3], 413[7], 414[9], 418[4].
Diacrisia virginica, 558[6].
diadema, Sinea, 550[5].
Diaphnidia pellucida, 551[9].
diceros, Ceresa, 552[7].
Dichrooscytus elegans, 552[2].
Dicraneura, 501[7], 542[2].
communis, 542[3], 556[3].
cruentata, 542[2].
fieberi, 542[4].
flavipennis, 542[5].
Dicyphus agilis, 551[9].
famelicus, 551[9].
didymus, Ischnorhynchus, 549[4].
Diedrocephala, 501[1], 510[7]–11[2].
sp., 511[6].
anguliferа, 511[6].
coccinea, 510[8], 553[7].
mollipes, 511[4], 511[8].
novaeboracensis, 511[9].
diffinis, Hemaris, 558[1].
dimidiana, Olethreutes, 561[5].
dimidiata, Phoesia, 559[9].
Diommatus congrex, 550[9].
Diplosis pini-rigidae, 419[7].
resinicola, 419[5].
Diplotaxus liberta, 422[2].
Diptera, collections, 362[2]; contributions of, 427[6]–28[4].
dipteroides, Microcoelia, 558[8].
discolor, Grabhamia, *see* Grabhamia discolor.
discoloralis, Renia, 559[7].
Disonycha triangularis, 415[6].
dispar, Porthetria, 382[3]–85[2].
distinctus, Bythoscopus, 504[2].
diversilineata, Eustroma, 560[6].
diversus, Culex, *see* Culex diversus.
divisata, Caripeta, 560[5].
Dog day cicada, 420[1].
dolobrata, Leptopterna, 550[7].
dorsalis, Grabhamia, 472[2].
dorsalis, Pissonotus, 553[1].
dorsalis, Stenocranus, 553[1].
dorsisignatana, Eucosma, 561[6].
Doryphora 10-lineata, 412[6], 413[7], 414[8], 416[3], 416[6].
Draeculacephala, 501[1], 511[2]–14[3].
anguliferа, 511[6].
mollipes, 511[3], 553[8].
novaeboracensis, 511[8], 553[8].
Drasterea erechtea, 559[5].
Drasterius elegans, 422[4].
Drepana arcuata, 560[3].
Driatura, 501[4], 529[4].
grammaroidea, 529[4].
drupiferarum, Sphinx, 558[2].
Dryobota illocata, 558[7].
Dryocoetes *sp.*, 419[8].
dubitans, Hadena, 558[9].
dupreei, Culicada, *see* Culicada dupreei.

Dust sprays, 419[1].
Dutchess county, summary of voluntary reports from, 416[1].
Dyar, H. G., acknowledgments to, 363[4], 443[5]; cited, 472[2].
dyari, Culicella, 445[9], 448[9], 479[9]–80[2].

eburata, Thamnotettix, 534[5].
Ecculex sylvestris, 447[6], 479[8].
Economic entomology, importance of laboratory and field work, 423[9].
Ectropis crepuscularia, 560[6].
Elder bushes, Ceresa diceros injuring, 552[7].
elegans, Dichrooscytus, 552[2].
elegans, Drasterius, 422[4].
elimata, Semiophora, 558[8].
Ellida caniplaga, 559[9].
Elm, insects injurious to:
flea beetle, 415[7].
Galerucella luteola, 405[6].
Macrodactylus subspinosus, 415[3].
Schizoneura americana, 406[2].
Typhlocyba tricincta, 544[8].
Elm aphid, 417[8].
Elm flea beetle, 415[6].
Elm gall, cockscomb, 424[2].
Elm leaf beetle, 359[6], 405[6], 414[4], 417[8], 418[2], 418[4], 422[3].
Elm leaf louse, woolly, 406[1].
Emphytus canadensis, 406[4].
Empoa coccinea, 544[5].
querci, 545[5].
Empoasca, 501[7], 542[6]–43[7].
alboneura, 543[5].
albopicta, 543[2].
atrolabes, 542[9], 556[4].
birdii, 543[4].
consobrina, 543[6].
flavescens, 543[3], 556[4].
flavescens *var.* birdii, 543[4].
mali, 543[1].
obtusa, 542[6].
smaragdula, 542[6].
trifasciata, 542[8].
viridescens, 543[6].
Enchenopa binotata, 420[1].
Ennomos magnarius, 560[7].
subsignarius, 560[7].
ennucleata, Synelys, 560[8].
Enodia portlandia, 557[6].
enotata, Philobia, 560[4].
Entomology, report of committee on, 425[1].
Eois inductata, 560[9].
Ephemeridae, contributions of, 431[5].
Epicauta pennsylvanica, 418[1].
Epidemia epixanthe, 557[8].
Epiplemidae, 561[1].
epixanthe, Epidemia, 557[8].
Epizeuxis aemula, 559[6].
americalis, 559[6].
lubricalis, 559[6].
erechtea, Drasterea, 559[5].
Eretmapodites quinquevittatus, 462[3].
explanation of plate, 562[3].
Erynnis sassacus, 557[9].
Erythroneura mali, 541[8].
obliqua, 545[1].
tricincta, 544[7].
vitifex, 545[3].
vulnerata, 545[4].
Euacanthus acuminatus, 512[4].
orbitalis, 512[4], 553[9].
Eubaphe aurantiaca, 558[5].
immaculata, 558[5].
Eucanthus, 501[1].
acuminatus, 512[3], 553[9].
Euchalcia contexta, 559[3].
Euchlaena astylusaria, 560[8].
johnsonaria, 560[8].
obtusaria, 560[8].
pectinaria, 560[8].
Euchoeca albovittata, 560
lucata, 560[5].
Eucirroedia pampina, 559[8].
Euclidia cuspidea, 559[5].
Eucorethra underwoodi, 449[7], 496[1].
Eucosma dorsisignatana, 561[6].
juncticiliana, 561[5].
Eucymatoge intestinata, 560[5].
Eudeilinea herminiata, 560[3].
Eudule mendica, 560[4].
Eueretagrotis perattenta, 558[8].
sigmoides, 558[8].
Eufidonia notataria, 560[9].
Eugonia j-album, 557[5].
Eugonobapta nivosaria, 560[7].
Euherrichia mollissima, 559[5].

Eumestleta flammicincta, 559[4].
Euphydryas phaeton, 557[5].
Euplexia lucipara, 558[7].
Euproctis chrysorrhoea, 385[3]–86[8].
Eupteryx, 501[7], 543[7].
  flavoscuta, 544[4], 556[5].
  nigra, 543[8]–44[4].
  vanduzei, 543[7], 556[4].
Eurymus interior, 557[1].
  philodice, 557[4].
eurytus, Cissia, 557[7].
Euschistus fissilis, 548[6].
  tristigmus, 548[7].
Eustroma destinata, 560[6].
  diversilineata, 560[6].
  populata, 560[6].
  prunata, 560[6].
  testata, 560[6].
Eustrotia carneola, 559[4].
  muscoscula, 559[4].
  musta, 559[4].
  synochitis, 559[4].
Eutettix, 501[5], 529[8]–31[9].
  brunneus, 530[5].
    figure, 530.
  cincta, 530[3].
  johnsoni, 531[8].
  jucundus, 530[3].
  lurida, 530[4].
  seminuda, 529[9]–30[2].
  southwicki, 531[7].
  strobi, 531[4].
Euthisanotia grata, 559[2].
Euvanessa antiopa, 557[5].
Everes comyntas, 557[5].
Evergestis rimosalis, 415[2].
  straminalis, 561[2].
Evetria comstockiana, 419[5].
  frustrana, 419[5].
  rigidana, 419[3].
excaecatus, Paonias, 558[2].
excultus, Jassus, 534[1].
excultus, Phlepsius, 534[1].
exesa, Oligia, 558[8].
eximus, Phytocoris, 550[9].
Explanation of plates, 562[1]–64[4].
expultrix, Pseudothyatira, 560[1].
exquisitos, Thamnotettix, *see* Thamnotettix exquisitos.
extrusus, Athysanus, 527[5], 555[3].
Fabricius, cited, 499[7].
fagi, Athysanus, 504[3].
fagi, Bythoscopus, 504[3].
falcigera, Autographa, 559[3].
falcigera a. simplex, Autographa, 559[3].
Fall apple leaf miner, 425[8].
Fall webworm, 405[9]–6[1], 413[3], 413[9], 414[2], 415[5].
Fallen, cited, 499[7].
Falvay, D. K., acknowledgments to, 364[4].
famelicus, Dicyphus, 551[9].
fasciata, Stegomyia, *see* Stegomyia fasciata.
fasciata, Tettigonia, 509[8].
fatigans, Culex, 483[4].
faunus, Polygonia, 557[6].
Felt, E. P., cited, 472[9], 498[3], 516[9], 532[6]; acknowledgments to, 499[3]; mentioned, 531[3], 546[2].
Feltia jaculifera, 559[2].
  jaculifera a. herilis, 559[2].
  subgothica, 559[2].
Feltidia, 472[3].
fenestratus, Athysanus, 503[3].
fenestratus, Bythoscopus, 503[3].
fenestratus, Pediopsis, 503[4].
Feniseca tarquinius, 557[8].
Ferns, Monolocoris filicis injuring, 551[6].
ferrugata, Petrophora, 560[8].
ferus, Coriscus, 550[3].
fervidana, Archips, 561[5].
fervidana, Cacoecia, 419[9].
fervidaria, Therina, 560[6].
Fidia viticida, 360[3], 364[1]–82[3], 418[9], 420[3], 421[3], 423[2], 423[4], 423[7], 425[1], 425[3].
fieberi, Dicraneura, 542[4].
filicis, Monolocoris, 551[6].
finitella, Tlascala, 561[3].
fissilis, Euschistus, 548[6].
Fitch, Asa, work of, 498[2]; cited, 498[3], 498[6], 499[7], 499[8], 502[4], 507[4], 507[6], 511[5], 512[4], 531[5], 533[2], 539[6], 544[6], 544[7], 545[6], 547[2], 547[4]; mentioned, 499[6], 516[6], 519[8].
fitchii, Culex, 425[6], 451[6]–54[1].
fitchii, Culicada, *see* Culicada fitchii.

fitchii, Thamnotettix, 535[9]–36[2].
flammicincta, Eumestleta, 559[4].
flavescens, Chlorita, 543[3].
flavescens, Cicada, 543[3].
flavescens, Empoasca, 543[3], 556[4].
flavescens *var.* birdii, Empoasca, 543[4].
flavicosta, Deltocephalus, 520[4].
flavicostatus, Deltocephalus, 520[5].
flavilineata, Gypona, 512[9].
flavipennis, Dicraneura, 542[5].
flavipes, Termes, 419[4].
flavipunctalis, Renia, 559[7].
flavivenata, Sciagraphia, 560[9].
flavoscuta, Eupteryx, 544[4], 556[5].
flavostriatus, Acocephalus, 515[1].
flavostrigatus, Acocephalus, 515[1].
Flea beetle, 415[1], 415[7].
  black, 412[1], 413[1], 414[8], 417[9].
florescens, Pediopsis, 504[8].
floricola, Chrysobothris, 419[7].
florida, Rhodophora, 559[2].
Flower fly, 408[6].
fluctuata, Petrophora, 560[8].
forceps, Scutigera, 424[3].
Forest insects, 419[2], 434[2]–35[4], 438[9]–39[9], 440[4].
Forester, 8-spotted, 416[8], 417[2].
forticornis, Biorhiza, 420[1].
fragilis, Apatela, 558[7].
franciscanus, Anopheles, 449[7].
Frank, G., acknowledgments to, 557[3].
frater, Raphia, 558[6].
fraternalis, Renia, 559[7].
fraternus, Plagiognathus, 552[3].
frontalis, Platymetopius, 517[7]–18[2].
Fruit tree bark beetle, 403[4], 421[4].
Fruit tree insects, 403[4]–5[5].
frustrana, Retinia, 419[5].
Fulgoridae, 552[8]–53[4].
fuliginosa, Phragmatobia, 558[6].
fuliginosus, Corethra, 458[3], 496[9].
fulvicollis, Scepsis, 558[4].
fulvidorsum, Jassus, 532[9].
fulvidorsum, Phlepsius, 532[8]–33[2], 555[5].
fulvocapitatus, Xestocephalus, 515[7].
fulvus, Platymetopius, 519[1].
fumida, Alebra, 542[1].
fumipennis, Pediopsis, 505[4].
furfura, Chionaspis, 421[6].
fuscipennis, Phlepsius, 532[7].
fuscus, Aedes, *see* Aedes fuscus.

galactinus, Piezostethus, 550[7].
Galasa, rubidana, 561[3].
galbanata, Chlorotettix, 538[8].
galbanatus, Athysanus, 538[9].
galeata, Archasia, 420[1].
Galerucella luteola, 359[6], 405[6], 414[4], 417[8], 418[2], 422[3].
Gall fly, pitch-pine needle, 419[7].
gallii, Deilephila, 558[1].
Galls, insect, 432[3]–34[2].
gammaroidea, Athysanus, 529[4].
Garden insects, 406[4]–8[9].
Gelechia pinifoliella, 419[7].
geminata, Gypona, 513[7]–14[3].
geminatella, Ornix, 404[7], 404[9], 425[9].
Genesee county, summary of voluntary reports from, 413[5]–14[3].
genetrix, Hadena, 558[9].
geniculata, Agrotis, 558[0].
Geometridae, 560[4].
Geranium robertsonium, Scaphoideus auronitens injuring, 524[6].
germana, Lithomoia, 559[6].
Gerridae, 550[2].
gibbosa, Nadata, 559[9].
Gillette, cited, 499[7], 542[2], 542[3], 543[4], 543[7], 544[9], 545[8].
gilvipennis, Rhynchagrotis, 558[7].
gilvipes, Mecomma, 551[8].
Gipsy moth, 382[3]–85[2]; description, 384[1]; recommendations, 384[9]–85[3].
glaucus, Papilio, 557[3].
Glena cognataria, 560[6].
Glossocratus viridis, 515[9].
  vulneratus, 516[1].
Gluphisia septentrionalis, 559[9].
Glyptoscelis pubescens, 419[6].
Gnathodus, 501[6].
  impictus, 541[4].
  punctatus, 541[1], 556[2].
  viridis, 541[4], 556[3].
Gnathotricus materiarius, 419[4].
godingi, Telamona, 420[1].
Goniognathus, 501[4], 529[7].
  palmeri, 529[7].
Gonodontis hypochraria, 560[8]
goodelli, Mamestra, 559[4].

Gortyna americana, 559[7].
gothica, Tettigonia, 510[1], 553[7].
Grabham, M., acknowledgments to, 443[4].
Grabhamia, 472[2].
discolor, 447[1], 472[5].
explanation of plate, 562[8].
dorsalis, 472[2].
jamaicensis, 446[6], 464[3], 472[2], 472[4].
grabhamii, Cyclol eppteron, *see* Cyclol eppteron grabhamii.
gracilis, Polygonia, 557[5].
Grain beetle, saw toothed, 422[2].
grammaroidea, Driatura, 529[4].
grandis, Camptobrochis, 551[5]
grandis, Mamestra, 559[4].
granitata, Sciagraphia, 560[4].
Grape, insects injurious to:
Typhlocyba comes, 545[3].
obliqua, 545[2].
tricincta, 544[7].
trifasciata, 544[8].
vulnerata, 545[5].
Grape gall fly, 416[9], 417[2].
Grape root worm, 359[7], 364[1]–82[3], 418[9], 420[3], 421[3], 423[2], 425[1], 425[3]; value of beetle catchers, 369[4]–71[6]; record of cage experiments, 367; eggs, 368[8]–69[3]; grubs taken in Falvay vineyard, 370[1]; investigations of, 360[2]; life history, 365[8]–66[5]; mortality and egg record of beetles from experimental areas *1904*, 378–79; recommendations, 381[6]–82[3]; restoration of injured vineyards, 380[5]–81[6]; scarcity of, 365[4]; table of spraying experiments at Portland *1904*, 374.
Grapeberry moth, 418[9].
Grapevine beetle, light-loving, 419[6].
spotted, 425[4].
Grapevine plume moth, 416[7].
Graphiphora peredia, 559[6].
Grass, insects injurious to:
Cicadula 6-notata, 540[2].
Draeculacephala mollipes, 511[6].
Protenor belfragei, 549[2].
Thamnotettix inornata, 555[8].
melanogaster, 537[9].
Grasshoppers, 415[5].
grata, Euthisanotia, 559[2].
gratulata, Mesoleuca, 560[6].
Greene county, summary of voluntary reports from, 414[3].
grisea, Xerophloea, 512[6].
guttata, Aulacizes, 509[6].
guttivitta, Heterocampa, 559[9].
Gypona, 501[2].
bipunctulata, 513[2], 513[4].
cana, 512[9].
flavilineata, 512[9].
geminata, 513[7]-14[3].
melanota, 513[3].
nigra, 513[3].
octo-lineata, 512[8]-13[2].
quebecensis, 512[9], 553[9].
rugosa, 513[6].
scarlatina, 513[4].
striata, 512[9].
Gyponinae, 501[1].
Gypsochroa designata, 560[8].
sitellata, 560[8].

Habrosyne rectangulata, 560.
scripta, 560[1].
Hadena apamiformis, 558[9].
arctica, 558[6].
binotata, 558[9].
devastatrix, 558[6].
dubitans, 558[9].
genetrix, 558[9].
lateritia, 558[9].
lignicolor, 558[7].
mactata, 558[9].
stipata, 558[9].
Haematobia serrata, 415[3].
Halisidota tessellaris, 558[6].
Halticus apterus, 551[8].
hamamelis, Apatela, 558[7].
Haploa confusa, 558[5].
lecontei, 558[5].
Harrington, cited, 547[8], 553[7].
Harris, cited, 547[6].
harrisii, Papaipema, 559[7].
haruspica, Noctua, 559[2].
hastata, Rheumaptera, 560[6].
Heidemann, cited, 549[7], 549[9].

Heliophila albilinea, 559[5].
commoides, 559[6].
insueta, 559[6].
luteopallens, 559[5].
pseudargyria, 559[5].
unipuncta, 559[5].
Hellebore, 424[4].
Helochara, 500[9].
communis, 512[1], 553[9].
helva, Orthosia, 559[1].
Hemaris diffinis, 558[1].
thysbe, 558[1].
Hemerocampa leucostigma, 405[8], 416[9], 418[1], 560[2].
hemidesma, Olethreutes, 561[5].
Hemileuca maia, 419[9].
Hemiptera, contributions of, 429[5]-31[3]; list taken in the Adirondack mountains, 546[1]-56[8].
Heodes hypophleas, 557[8].
herbida, Tettigonia, 512[1].
herculaneus, Camponotus, 419[9].
Herkimer county, summary of voluntary reports from, 414[6]-15[7].
herminiata, Eudeilineata, 560[3].
Herrick, Glenn W., acknowledgments to, 443[5].
Hesperidae, 557[8].
hesperius, Labops, 551[6].
Heterocampa biundata, 559[9].
guttivitta, 559[9].
manteo, 559[9].
Heterogramma pyramusalis, 559[7].
Hickory, Penthimia americana injuring, 514[5].
Hickory leaf gall, 425[8].
hieroglyphica, Tettigonia, 510[1], 553[7].
Hine, J. S., mentioned, 535[7].
hirticulus, Lygus, 551[4].
hirtipes, Cecidomyia, 410[4]–11[4].
histrionicus, Peltonotus, 553[4].
hobomok, Atrytone, 557[9].
homodactylus, Pterophorus, 561[4].
Homoemus aeneifrons, 546[9], 548[3].
Homoptera, 552[5]–56[8].
Hornbeam, Bythoscopus nigrinasi injuring, 504[1].
Hornfly, 415[3], 415[5].
Horsechestnuts, Hemerocampa leucostigma injuring, 405[8].
hortuellus, Crambus, 561[3].
Hough beetle catcher, 369[4].
Houghton, C. O., cited, 547[4], 548[1].
Howard, L. O., acknowledgments to, 363[3].
Howardina walkeri, 449[4].
Huckleberry bushes, insects injurious to:
Cixius colocpium, 552[9].
Pilophorus clavipes, 551[7].
hudsoni, Sayomyia, 497[2].
Hüeber, cited, 552[3].
humarium, Selidosema, 560[5].
humerosana, Amorbia, 561[6].
humidus, Phlepsius, 532[1].
huntera, Vanessa, 557[5].
Hyaliodes vitripennis, 551[7].
Hydria undulata, 560[5].
Hydriomena custodiata, 560[7].
latirupta, 560[7].
unangulata, 560[7].
Hydrocyanic acid gas, 410[3].
Hydrometridae, 550[1].
Hygrotrechus remigis, 550[2].
Hylobius pales, 419[5].
Hylotoma pectoralis, 425[7].
Hymenoptera, collections, 362[2]; contributions of, 426[4].
Hyperitis amicaria, 560[7].
Hyphantria textor, 405[9]-6[1], 413[3], 413[9], 415[5].
hypochraria, Gonodontis, 560[8].
hypophleas, Heodes, 557[8].
Hypoprepia miniata, 558[4].
Hyppa xylinoides, 558[7].

icelus, Thanaos, 557[9].
Idiocerus, 500[8].
alternatus, 506[4], 554[5].
crataegi, 507[2].
lachrymalis, 502[7], 507[2], 554[5].
maculipennis, 507[5].
nervatus, 506[3].
obsoletus, 505[9].
pallidus, 505[9]–6[2], 554[4].
provancheri 507[7], 554[5].
suturalis, 506[7], 554[4].
var. lunaris, 507[1], 554[4].
verticis, 507[9]–8[1].
illinoiensis, Typhlocyba, 545[9].
illocata, Dryobata, 558[7].

imbrifera, Mamestra, 559[3].
immaculata, Eubaphe, 558[5].
immistus, Jassus, 525[6].
immistus, Scaphoideus, 525[6], 555[7].
Imperial moth, 419[6].
imperialis, Basilona, 419[6].
impictus, Gnathodus, 541[4].
impiger, Culex, 451[8].
impiger, Culicada, *see* Culicada impiger.
impressa, Apatela, 558[7].
inatomaria, Metanema, 560[8].
incidens, Theobaldia, *see* Theobaldia incidens.
incisus, Phlepsius, 533[3], 555[6].
indicataria, Cleora, 560[5].
inductata, Eois, 560[9].
inermis, Stictocephala, 420[1].
infuscata, Thamnotettix, 537[1], 555[9].
inimica, Tettigonia, 523[3].
inimicus, Amblycephalus, 523[3].
inimicus, Deltocephalus, 523[2], 523[4], 555[2].
inimicus, Jassus, 523[2].
innotata, Tettigonia, 511[3].
inornata, Thamnotettix, 536[3], 555[8].
inscriptus, Coriscus, 550[3].
Insect depredations, 423[2]; cause and control, 421[6].
Insects and fungus, 421[4].
insidiosus, Triphleps, 550[7].
insignis, Pediopsis, 504[5].
instabilis, Athysanus, 528[6].
insueta, Heliophila, 559[6].
insula, Paragrotis, 559[3].
integer, Janus, 413[6].
interior, Eurymus, 557[4].
intermedia, Apantesis, 558[5].
intermedia, Cucullia, 559[7].
intermicata, Lychnosea, 560[6].
interrupta, Apatela, 558[7].
interruptofasciata, Tephroclystis, 560[5].
intestinata, Eucymatoge, 560[5].
intricatus, Scaphoideus, 525[2].
invitus, Lygus, 551[3].
io, Automeris, 558[3].
Ipimorpha pleonectusa, 559[1].
iris, Brotoloma, 559[8].
irrorata, Aulacizes, 509[5].
irrorata, Cicada, 509[5].
irroratus, Allygus, 533[5].
irroratus, Jassus, 533[4].
irroratus, Phlepsius, 533[4].
isabella, Isia, 558[5].
Ischnorhynchus didymus, 549[4].
resedae, 549[4].
Isia isabella, 558[5].

j-album, Eugonia, 557[5].
jaculifera, Feltia, 559[2].
jaculifera a. herilis, Feltia, 559[2].
jamaicensis, Grabhamia, *see* Grabhamia jamaicensis.
jamaicensis, Smerinthus, 558[2].
jamesii, Nyssorhynchus, 470[8]–71[2].
Janthinosoma lutzii, 471[9]–72[1].
explanation of plate, 562[7].
musica, 446[6], 471[7].
Janus integer, 413[6].
Jassidae, 361[2], 500[7], 501[2], 514[6]–41[7], 554[7]–56[3].
Jassidae of New York State, by Herbert Osborn, 498[1]–545[9].
Jassinae, 501[3].
Jassoidea, synopsis of families, 500[5]; genera represented in New York, 500[8]–1[7].
Jassus, 501[5].
acutus, 516[7].
belli, 534[4].
clitellarius, 534[7].
excultus, 534[1].
fulvidorsum, 532[9].
immistus, 525[6].
inimicus, 523[2].
irroratus, 533[4].
melanogaster, 537[9].
nervatus, 529[2].
novellus, 508[7].
olitorius, 539[4], 539[5].
plutonius, 528[4].
punctatus, 541[2].
punctifrons, 540[8].
sayi, 519[6].
seminudus, 529[9].
6-punctatus, 523[4].
subbifasciatus, 539[5].
variatus, 540[4].
verticis, 507[9].

johnsonaria, Euchlaena, 560[8].
johnsoni, Eutettix, 531[8].
jucunda, Noctua, 559[1].
jucundus, Eutettix, 530[3].
jucundus, Scaphoideus, 524[8].
juglandis, Corythuca, 549[7].
juglandis, Cressonia, 558[2].
Julus caeruleocinctus, 422[9], 423[7].
juncticiliana, Eucosma, 561[5].
June beetle, 417[6].

kalmiae, Sphinx, 558[2].
karnerensis, Corethra, 451[8], 454[8], 496[7].
Kearfott, W. D., acknowledgments to, 557[3].
Kellogg, V. L., acknowledgments to, 443[5].
kennicottii, Thamnotettix, 534[2], 555[7].
Kerosene, 408[8].
Key to Culicidae larvae, 445[6]–49[8].
Kybos smaragdulus, 542[7].

Labops hesperius, 551[6].
Laccocera vittipennis, 553[2].
Lace-winged fly, 408[6].
Lachnosterna *sp.*, 417[6].
lachrymalis, Bythoscopus, 507[3].
lachrymalis, Idiocerus, 502[7], 507[2], 554[5].
lacustrata, Mesoleuca, 560[7].
ladon, Cyaniris, 557[3].
Lady beetle, 408[5].
2-spotted, 418[4].
laevigata, Zanclognatha, 559[7].
Lamenia vulgaris, 553[4].
laminalis, Liburnia, 553[3].
lanigera, Schizoneura, 414[9].
lardarius, Dermestes, 409[8]–10[4], 424[9].
Larder beetle, 409[8]–10[4], 424[9].
larvaria, Cleora, 560[8].
Lasiocampidae, 560[3].
Lasioptera vitis, 416[9].
lateralis, Acanthosoma, 549[1].
lateralis, Cicada, 509[3].
lateralis, Oncometopia, 509[3].
lateritia, Hadena, 558[9].
latex, Mamestra, 559[4].
latirupta, Hydriomena, 560[7].
lazarensis, Culex, 425[6].
lazarensis, Culicada, 448[8], 478[8].
Leaf hoppers, 361[2].
Leaf miners, fall apple, 404[5]–5[5].
pine, 419[7].
Lecanium cerasifex, 412[8].
lecontei, Haploa, 558[5].
lecontei, Lophyrus, 419[6].
Le Conte's sawfly, 419[6].
leonardus, Anthomaster, 557[9].
lepida, Cicadula, 540[9].
Lepidoptera, contributions of, 428[6]-29[4]; taken at Keene Valley, N. Y., list of, by G. F. Comstock, 557[1]-61[1].
Lepidosaphes ulmi, 414[9], 421[2], 421[4].
Leptomeris quinquelinearia, 560[9].
Leptopterna dolobrata, 550[7].
Lepyronia 4-angularis, 553[5].
leucostigma, Hemerocampa, *see* Hemerocampa leucostigma.
leucostigma, Notolophus, 422[3].
Lexis bicolor, 558[4].
libatrix, Scoliopteryx, 559[8].
liberta, Diplotaxus, 422[2].
Liburnia campestris, 553[3].
laminalis, 553[3].
lutulenta, 553[3].
pellucida, 553[2].
puella, 553[2].
lignicolor, Hadena, 558[7].
Ligyrocoris balteatus, 549[6].
constricta, 549[7].
contracta, 549[6].
sylvestris, 549[5].
limata, Pantographa, 561[2].
limbata, Ania, 560[8].
Lime-sulfur combinations laboratory experiments, 387[7]-91[4].
Lime-sulfur wash, 360[4], 386[9]-403[3], 419[2], 420[2], 421[1], 422[1]; field experiments with, 392-98[7].
Limnotettix striola, 527[7].
Limotettix variata, 540[4].
lineata, Aulacizes, 511[4].
lineata, Deilephila, 558[2].
lineatum, Rhagium, 419[4].
lineatus, Philaenus, 546[9], 553[5].
lineatus, Poecilocapsus, 551[5].
Linnaeus, cited, 499[7].
lintneri, Corethra, 496[6].

Liparidae, 560[2].
Lithocolletes blancardella, 404[7], 425[9].
Litholomia napae, 559[6].
Lithomoia germana, 559[6].
Lithosiidae, 558[4].
lobatus, Scaphoideus, 524[2].
London purple, 404[4].
Lophyrus lecontei, 419[6].
Lopidea media, 550[8].
lorea, Mamestra, 559[5].
Louisiana purchase exposition, insect exhibit, 431[9]-426[6].
Lowe, V. H., mentioned, 387[4].
lubricalis, Epizeuxis, 559[6].
lucata, Euchoeca, 560[5].
lucicola, Anomala, 419[6].
lucilius, Thanaos, 557[9].
lucipara, Euplexia, 558[7].
Ludlow, C. S., acknowledgments to, 443[4].
Lugger, cited, 409[4].
luna, Tropaea, 558[3].
lurida, Eutettix, 530[4].
lurida, Thamnotettix, 530[4].
lusoria, Chlorotettix, 539[2], 55[1]
lusoria, Thamnotettix, 539[2].
lustralis, Mamestra, 559[3].
lutea, Stictocephala, 552[7].
luteata, Tephroclystis, 560[4].
luteola, Galerucella, *see* Galerucella luteola.
luteolus, Scaphoideus, 524[1].
luteopallens, Heliophila, 559[5].
lutulenta, Liburnia, 553[3].
lutzii, Janthinosoma, *see* Janthinosoma lutzii.
Lycaenidae, 557[7].
Lychnosea intermicata, 560[6].
Lycia cognataria, 560[6].
Lycomorphia pholus, 558[4].
Lygaeidae, 549[3].
Lygus *sp.*, 551[4].
hirticulus, 551[4].
invitus, 551[3].
invitus *var.*, 551[3].
pabulinus, 551[3].
pratensis, 551[3].
Lymnadidae, 557[7].
Mac Gillivray, A. D., cited, 546[3], 547[3], 548[1], 548[6], 548[7], 548[8], 548[9], 549[1], 549[4], 549[8], 549[9], 550[3], 550[5], 550[6], 551[6], 551[9], 552[7], 553[2], 554[2], 555[3], 555[4], 555[5], 556[7].
macgillivrayi, Cicadula, 541[1].
Machimia tentoriferella, 561[7].
Macrodactylus subspinosus, 415[2], 417[6].
mactata, Hadena, 558[9].
maculipennis, Anopheles, 449[6], 470[1].
maculipennis, Bythoscopus, 507[6].
maculipennis, Idiocerus, 507[5].
maculiventris, Podisus, 548[9].
Magdalis alutacea, 419[5].
perforata, 419[5].
magnarius, Ennomos, 560[7].
magnipennis, Culiseta, 448[4].
magnoliata, Coenocalpe, 560[7].
maia, Hemileuca, 419[9].
Maia moth, 419[9].
Mail during year, 360[2].
majestus, Phlepsius, 533[6].
major, Xerophloea, 512[7].
Malacosoma americana, 412[9], 413[1], 414[4], 414[7], 416[6], 417[5], 418[2], 418[5], 560[3].
malana, Balsa, 558[8].
mali, Aphis, 416[4], 422[2].
mali, Empoasca, 543[1].
mali, Erythroneura, 541[8].
mali, Monarthrum, 419[8].
mali, Tettigonia, 543[1].
malifoliella, Tischeria, 404[9], 425[9].
malina, Sthenarops, 551[7].
Mamestra adjuncta, 559[4].
detracta, 559[4].
goodelli, 559[4].
grandis, 559[4].
imbrifera, 559[3].
latex, 559[4].
lorea, 559[5].
lustralis, 559[3].
mediata, 559[4].
nimbosa, 559[3].
olivacea, 559[5].
purpurissata, 559[3].
renigera, 559[4].
Mansonia titillans, 462[3].
explanation of plate, 562[2].

manteo, Heterocampa, 559[9].
Maple, insects injurious to:
Penthimia americana, 514[5].
Thiodia signatana, 415[7].
Maple, hard, Aphis mali injuring, 418[2].
marcidilinea, Zanclognatha, 559[7].
margaritosa, Peridroma, 558[9].
margaritosa a. saucia, Peridroma, 558[9].
marginatus, Cyrtorrhinus, 550[9].
marginella, Cicada, 509[3].
marjoraria, Caberodes, 560[9].
Marmopteryx marmorata, 560[7].
marmorata, Carynota, 552[7].
marmorata, Marmopteryx, 560[7].
Marumba modesta, 558[1].
materiarius, Gnathotricus, 419[4].
Mecomma gilvipes, 551[8].
media, Lopidea, 550[8].
mediata, Mamestra, 559[4].
Megamelus notulus, 553[1].
Megarhinus portoricensis, 449[4], 494[1].
explanation of plate, 564[3].
Megoura solani, 414[2].
meilleuri, Collaria, 550[8].
Meinert, F., collection received from, 362[3]; cited, 475[2].
melaleucana, Archips, 561[6].
Melalopha albosigma, 559[5].
Melaniconion atrata, 487[4].
explanation of plate, 563[8].
melanogaster, Ceresa, 552[7].
melanogaster, Jassus, 537[9].
melanogaster, Thamnotettix, 537[8].
Melanolophia canadaria, 560[6].
melanota, Gypona, 513[3].
melanurus, Culicella, 445[9], 480[2].
Melinna modesta, 551[2].
mellistrigata, Sciagraphia, 560[4].
melsheimeri, Amblycephalus, 521[7].
melsheimeri, Deltocephalus, 521[7]–22[5], 522[6], 554[9].
Membracidae, 552[5].
mendica, Eudule, 560[4].
Mesoleuca gratulata, 560[6].
lacustrata, 560[7].
ruficilliata, 560[6].
truncata, 560[7].
messoria, Agrotis, 407[4].
messoria, Paragrotis, 424[2].
Metanema determinata, 560[9].
inatomaria, 560[8].
textrinaria, 560[9].
Metathorasa monitifera, 559[5].
Metcalfe, mentioned, 533[9].
Metrocampa praegrandaria, 560
Microcoelia dipteroides, 558[8].
Microvelia americana, 550[1].
milberti, Aglais, 557[5].
Milliped, blue-banded, 422[9].
Mineola tricolorella, 561[3].
minians, Nephelodes, 559[5].
miniata, Hypoprepia, 558[4].
minki, Deltocephalus, 520[1], 554[8].
minor, Bythoscopus, 503[7], 554[1].
miranda, Caradrina, 558[8].
Miris affinis, 550[8].
rubellus, 550[8].
mixta, Tettigonia, 515[3].
mixtus, Acocephalus, 515[1]
modesta, Marumba, 558[1].
modesta, Melinna, 551[2].
modestus, Podisus, 548[9].
mollipes, Diedrocephala, 511[1], 511[8].
mollipes, Draeculacephala, 511[3], 553[8].
mollipes, Tettigonia, 511[3].
mollissima, Euherrichia, 559[5].
Monarthrum mali, 419[8].
monitifera, Metathorasa, 559[5].
Monohammus confusor, 419[4], 424[4].
Monolocoris filicis, 551[6].
Montgomery county, summary of voluntary reports from, 415[8].
monticola, Thelia, 420[1].
morensata, Nannia, 560[4].
Mormidea undata, 548[5].
morula, Apatela, 558[7].
Mosquitos, 412[9], 419[1]; investigations of, 360[9]–61[1]; extermination, New York state's part in, 421[2]; as a menace to health, 421[8]; studies in, 442[6]–97[6].
brown wood, 448[7].
giant, 448[2].
golden, 448[9].
house, 446[2].
little black, 445[8].
northern gray, 447[5].

Mosquitos (*continued*)
salt marsh, 449[2].
brown salt marsh, 448[8].
small salt marsh, 449[1].
swamp, 447[6].
unbanded marsh, 445[8].
white dotted, 446[1].
woodland pool, 448[6].
yellow fever, 449[3].
Mucidus alternans, 462[3], 473[4], explanation of plates, 562[2], 562[9].
muscoscula, Eustrotia, 559[4].
musculus, Anthocoris, 550[6].
musica, Janthinosoma, 446[6], 471[7].
musta, Eustrotia, 559[4].
mutabilis, Crambus, 561[3].
Myriapoda, contributions of, 431[7].
myrina, Brenthis, 557[5].
mystic, Thymelicus, 557[3].
Myzus cerasi, 414[7], 422[2].

Nadata gibbosa, 559[9].
Nannia morensata, 560[4].
Nantucket pine moth, 419[5].
napae, Litholomia, 559[6].
napi, Pieris, 557[4].
nasicus, Balaninus, 420[2].
Neaborus *n. gen. et sp., near*, 551[4].
nebulosus, Camptobrochis, 551[6].
nebulosus, Phlepsius, 532[4].
Necrophorus americanus, 425[4].
Nectarophora pisi, 408[2], 416[5], 421[8].
Needham, James G., mentioned, 360[8].
negundinis, Chaitophorus, 414[8].
Nemoria pistaceata, 560[9].
Neottiglossa undata, 548[8].
Nephelodes minians, 559[5].
Nepytia semi clusaria, 560[5].
nervatus, Idiocerus, 506[3].
nervatus, Jassus, 529[2].
nervosus, Acocephalus, 514[9].
Neurocolopus nubilus, 551[1].
Neuroptera, contributions of, 429[4].
Neuroterus batatus, 425[7].
New York entomologic service, 423[1], 423[5], 423[6], 423[8].
Newell, Wilmon, mentioned, 360[6], 411[6].
niger, Aradus, 549[3].
nigra, Eupteryx, 543[8]-44[4].
nigra, Gypona, 513[3].
nigrifrons, Deltocephalus, 522[9]-23[2].
nigrinasi, Athysanus, 503[9].
nigrinasi, Bythoscopus, 503[9]-4[1].
nigripennis, Cicada, 509[5].
nigristernum, Corizus, 549[3].
nimbosa, Mamestra, 559[3].
nitela, Papaipema, *see* Papaipema nitela.
niveus, Oecanthus, 421[8].
nivosaria, Eugonobapta, 560[7].
Nixon, Ivan L., appointed assistant, 359[9]; observations and experiments, 364[2].
Noctua bicarnea, 559[1].
c-nigrum, 559[1].
clandestina, 559[2].
collaris, 559[2].
haruspica, 559[2].
jucunda, 559[1].
normaniana, 558[9].
phyllophora, 559[1].
plecta, 559[1].
smithii, 558[9].
noctuella, Nomophila, 561[3]
Noctuidae, 558[6].
Nola ovilla, 561[1].
Nolidae, 561[1].
Nomophila noctuella, 561[3].
normaniana, Noctua, 558[9].
notata, Philobia, 560[4].
notataria, Eufidonia, 560[9].
Notes for the year, 403[3]-11[8].
Notodonta basitriens, 559[9].
Notodontidae, 559[8].
Notolophus antiqua, 560[2].
leucostigma, 422[3].
Notonecta undulata, 552[4].
Notonectidae, 552[4].
notoscripta, Stegomyia, 490[2].
notulus, Megamelus, 553[1].
novaeboracensis, Aulacizes, 511[8].
novaeboracensis, Corizus, 549[2].
novaeboracensis, Diedrocephala, 511[9].
novaeboracensis, Draeculacephala, 511[8], 553[8].
novella, Agallia, 508[7], 554[6].
novellus, Agallia, 508[7].
novellus, Jassus, 508[7].

nubilus, Neurocolpus, 551[1].
Nursery certificates, 362[6]-63[1].
Nymphalidae, 557[4].
Nysius, *sp.*, 549[3].
angustatus, 549[3].
Nyssorhynchus jamesii, 470[8]-71[2].

Oak, insects injurious to: 419[9]-20[2], 440[8]-41[3].
Typhlocyba querci, 545[6].
Oak caterpillar, yellow striped, 419[9].
Oak fig gall, 420[1].
Oak potato gall, 425[8].
obesa, Rhagovelia, 550[1].
obliqua, Erythroneura, 545[1].
obliqua, Tettigonia, 545[1].
obliqua, Typhlocyba, 545[1].
obscurus, Plagiognathus, 552[2].
obscurus, Platymetopius, 518[3].
obsoletana, Archips, 561[5].
obsoletus, Athysanus, 526[6].
obsoletus, Idiocerus, 505[9].
obtectus, Deltocephalus, 521[3].
obturbans, Desvoidea, 473[1].
obtusa, Clastoptera, 553[6].
obtusa, Empoasca, 542[6].
obtusaria, Euchlaena, 560[8].
ocellana, Tmetocera, 418[5].
ochraceus, Scaphoideus, 525[1].
octo-lineata, Gypona, 512[8]-13[2].
octo-lineata, Tettigonia, 512[9].
octo-natata, Typhlocyba, 545[4].
octomaculata, Alypia, 416[8].
octoscripta, Autographa, 559[3].
oculata, Bruchomorpha, 553[4].
oculatus, Alaus, 409[1], 423[5].
Oecanthus niveus, 421[8].
pini, 419[8].
Oecophoridae, 561[7].
Olene plagiata, 560[2].
Olethreutes campestrana, 561[5].
dealbana, 561[5].
dimidiana, 561[5].
hemidesma, 561[5].
Oligia exesa, 558[8].
olitaria, Coelidia, 539[4].
olitorius, Jassus, 539[4], 539[5].
olivacea, Mamestra, 559[5].
Oncometopia, 500[9], 509[1].
costalis, 546[9], 553[6].
lateralis, 509[3].
undata, 509[1].
Onion fly, 418[3].
Onion maggot, 412[1].
opalinus, Scaphoideus, 525[8]-26[6].
ophthalmica, Baileyi, 558[6].
Orange county, summary of voluntary reports from, 415[9].
orbitalis, Euacanthus, 512[1], 553[9].
Oreta rosea, 560[3].
Orleans county, summary of voluntary reports from, 416[3].
Ornix geminatella, 404[7], 404[9], 425[9].
orphisalis, Pyrausta, 561[1].
Orthodes crenulata, 559[6].
vecors, 559[6].
Orthofidonia vestaliata, 560[9].
Orthoptera, contributions of, 431[3].
Orthosia bicolorago, 559[1].
helva, 559[1].
Orthotylus chlorionis, 552[2].
Osborn, Herbert, work of, 361[2]; Jassidae of New York State, 498[1]–545[9]; cited, 499[7], 507[7], 508[9], 522[9], 523[1], 524[5], 528[3], 528[7], 547[9], 552[6], 554[3]; mentioned, 546[7].
osborni, Athysanus, 527[9].
osborni, Deltocephalus, 527[9].
Osten Sacken, cited, 410[7].
otho, Thymelicus, 557[9].
ovilla, Nola, 561[1].
Owl beetle, 409[1], 423[4].
Oxyptilus periscelidactylus, 416[7].
Oyster shell scales, 414[9].

pabulinus, Lygus, 551[3].
palaemon, Pamphila, 557[9].
paleacea, Cosmia, 559[1].
Paleacrita vernata, 416[1], 418[5].
paleacus, Pterophorus, 561[4].
pales, Hylobius, 419[5].
Pales weevil, 419[5].
palliatricula, Chytonix, 558[8].
pallida, Alebra, 541[8].
pallidus, Bythoscopus, 505[9].
pallidus, Idioceris, 505[9]–6[2], 554[4].
pallipes, Salda, 550[6].

palmeri, Goniagnathus, 529[7].
Palthis angulalis, 559[8].
paludata, Carsia, 560[4].
Pamphila palaemon, 557[9].
pampina, Eucirroedia, 559[8].
pampinaria, Cleora, 560[6].
panalectros, Desvoidea, *see* Desvoidea panalectros.
Panapoda rufimargo, 559[6].
Panchrysia purpurigera, 559[2].
pandorus, Pholus, 558[2].
Pansies, Emphytus canadensis injuring, 406[5].
Pantographa limata, 561[2].
Paonias excaecatus, 558[2].
Papaipema harrisii, 559[7].
nitela, 406[9]–7[3], 415[2], 415[9], 417[7].
Papilio glaucus, 557[3].
polyxenes, 557[3].
Papilionidae, 557[3].
Parabolocratus, 501[3], 515[3].
viridis, 515[8].
vitellinus, 516[4].
Paracoelidia, 501[6].
tuberculata, 539[7].
Paragrotis insula, 559[3].
messoria, 424[2].
redimicula, 559[3].
scandens, 559[3].
tessellata, 559[3].
parallela, Aphrophora, 419[6].
Parallelia bistriaris, 559[6].
Paramesus, 501[3], 516[3].
vitellinus, 516[3], 554[7].
Paraphlepsius ramosus, 532[2].
Parapholis peltata, 512[6].
Paris green, 404[4], 407[6].
Parish, H. M., mentioned, 537[7].
Parrott, P. J., mentioned, 387[4], 398[9], 402[6].
parthenice, Apantesis, 558[5].
Pea, Nectarophora pisi, injuring, 408[2].
Pea aphid, 416[5].
Pea louse, 408[2], 421[6].
Peach leaf curl, 400[5].
Peachtree, insects injurious to:
Aphis mali, 416[7].
Scolytus rugulosus, 403[5].
Pear psylla, 359[5], 412[2], 412[8], 413[2], 414[3], 416[2], 416[3], 417[3], 417[5], 418[6], 422[2], 422[3], 422[5], 425[2].
Peartree, insects injurious to:
Euproctis chrysorrhoea, 385[4], 386[2].
Lecanium cerasifex, 412[8].
Psylla pyricola, 412[8], 413[2], 414[3], 416[2].
Schizura concinna, 404[4].
peckius, Polites, 557[9].
pectinaria, Euchlaena, 560[8].
pectoralis, Hylotoma, 425[7].
Pediopsis, 500[8].
basalis, 505[4], 554[3].
bifasciata, 504[9]–5[2].
canadensis, 504[8], 554[3].
fenestratus, 503[4].
florescens, 504[8].
fumipennis, 505[4].
insignis, 504[5].
reversalis, 505[3].
suturalis, 505[2].
trimaculata, 504[4], 504[9], 554[2].
virescens *var.* graminea, 505[5].
viridis, 504[6], 554[2].
Pegomyia brassicae, 422[2].
Pelidnota punctata, 425[4].
pellucida, Diaphnidia, 551[9].
pellucida, Liburnia, 553[2].
peltata, Parapholis, 512[6].
peltata, Xerophloea, 512[6].
Peltonotus histrionicus, 553[4].
pennsylvanica, Epicauta, 418[1].
Pentatomidae, 548[3]–49[1].
Penthimia, 501[2], 514[3].
americana, 514[3].
picta, 514[4].
vicaria, 514[4].
perattenta, Eueretagrotis, 558[8].
peredia, Graphiphora, 559[6].
perforata, Magdalis, 419[5].
periculosa, Trigonophora, 559[8].
Peridroma margaritosa, 558[9].
margaritosa a. saucia, 558[9].
Perigea vecors, 558[8].
periscelidactylus, Oxyptilus, 416[7].
perniciosus, Aspidiotus, *see* Aspidiotus perniciosus.
persicana, Archips, 561[5].
persicoides, Cecidomyia, 425[8].

pertextalis, Pyrausta, 561[3].
perturbans, Taeniorhynchus, *see* Taeniorhynchus, perturbans.
petrealis, Chytolita, 559[7].
Petroleum, crude, 419[2], 421[1], 422[1].
Petrophora ferrugata, 560[8].
fluctuata, 560[8].
phaeton, Euphydryas, 557[5].
Phantom larvae, 449[8].
Pheosia dimidiata, 559[9].
Philaenus lineatus, 546[9], 553[5].
Philobia notata, 560[4].
notata, 560[4].
philodice, Eurymus, 557[4].
Phlaeosinus dentatus, 419[9].
Phlegyas abbreviatus, 549[4].
Phlepsius, 501[5], 532[1].
apertus, 532[6], 555[6].
decorus, 533[8].
excultus, 534[1].
fulvidorsum, 532[8]-33[2], 555[5].
fuscipennis, 532[7].
humidus, 532[1].
incisus, 533[3], 555[6].
irroratus, 533[4].
majestus, 533[6].
nebulosus, 532[4].
strobi, 531[4].
Phlyctaenia terrealis, 561[3].
tertialis, 561[3].
phoenicealis, Pyrausta, 561[2].
pholus, Lycomorpha, 558[4].
Pholus pandorus, 558[2].
Phorbia brassicae, 413[3].
ceparum, 418[3].
photophila, Typhlocyba, 543[1].
Phragmatobia fuliginosa, 558[5].
Phyciodes batesii, 557[6].
tharos, 557[5].
phyllophora, Noctua, 559[1].
Physatochila plexa, 549[8].
Physostegania pustularia, 560[9].
Phytocoris breviusculus, 551[1].
eximus, 550[9].
picta, Penthimia, 514[4].
picta, Tettigonia, 510[8].
pictipes, Sesia, 561[2].
Pieridae, 557[3].
Pieris napi, 557[4].
rapae, 412[9], 416[8], 418[3], 557[4].
Piezostethus galactinus, 550[7].
Pilophorus clavipes, 551[7].
Pine, insects injurious to, 419[3].
Gypona geminata, 514[2].
Paracoelidia tuberculata, 539[7].
Pilophorus clavipes, 551[7].
Pine, hard, insects affecting, 441[4].
Pine, white, insects affecting, 440[5].
Pine bark beetle, 419[4].
Pine bark Chermes, 419[5].
Pine Chrysomela, 419[6].
Pine flower cricket, 419[8].
Pine leaf miner, 419[7].
Pine leaf scale insect, 419[7].
Pine moth, Nantucket, 410[5].
Pine sawyer, 419[4].
Pine weevil, white, 419[4].
pini, Oecanthus, 419[8].
pini, Tomicus, 419[4].
pini-rigidae, Diplosis, 419[7].
pinicorticis, Chermes, 419[6].
pinifoliae, Chionaspis, 419[7].
pinifoliella, Gelechia, 419[7].
Pinipestis zimmermani, 419[5].
pipiens, Culex, 446[2], 483[1].
pisi, Nectarophora, 408[2], 416[5], 421[6].
Pissodes strobi, 419[4].
Pissonotus dorsalis, 553[1].
pistaceata, Nemoria, 560[9].
Pitch-inhabiting midge, 419[5].
Pitch-pine needle gall fly, 419[7].
Pitch pine Retinia, 419[5].
Pitch tip moth, 419[5].
Pitch twig moth, 419[5].
Pityogenes *sp.*, 419[4].
Pityophthorus *sp.*, 419[4].
placidus, Thamnotettix, 536[5], 555[8].
plagiata, Olene, 560[2].
Plagiognathus fraternus, 552[3].
obscurus, 552[2].
politus, 552[3].
Plagionotus speciosus, 423[7].
Plagodis serinaria, 560[7].
Plant lice, 359[5], 412[2], 413[6], 413[9], 414[2], 414[8], 415[3], 415[5], 416[4], 416[7], 417[5], 417[7], 418[1], 422[5], 425[2], 425[4].
Plaster of paris, 406[9].
Plates, explanation of, 562[1]-64[4].
platycnemis, Buenoa, 552[4].

Platymetopius, 501[3]. 516[6]-23[5].
acutus, 516[7], 554[7].
albopunctatus, 517[7].
angustatus, 518[4].
cuprescens, 517[1].
frontalis, 517[7]-18[2].
fulvus, 519[1].
obscurus, 518[3].
Platypterygidae, 560[3].
Platysenta videns, 558[8].
plecta, Noctua, 559[1].
pleonectusa, Ipimorpha, 559[1].
plexa, Physatochila, 549[8].
plexippus, Anosia, 557[7].
Plumtree, insects injurious to:
Aphis mali, 416[7].
Schizura concinna, 404[4].
Scolytus rugulosus, 403[5].
Plusia aerea, 559[2].
aeroides, 559[2].
balluca, 559[2].
plutonius, Athysanus, 528[4], 555[3].
plutonius, Jassus, 528[4].
Pneumaculex signifer, 446[6], 490[6].
explanation of plate, 564[1].
Podisus maculiventris, 548[9].
modestus, 548[9].
sereiventris, 548[9].
Poecilocapsus lineatus, 551[5].
Poeciloscytus unifasciatus, 551[4].
Polites peckius, 557[9].
politus, Plagiognathus, 552[3].
politus, Xyloterus, 419[8].
pollinosa, Aulacizes, 509[6].
Polychrosis botrana, 418[9].
Polygonia comma, 557[6].
faunus, 557[6].
gracilis, 557[5].
progne, 557[5].
Polygonum, Phlepsius humidus injuring, 532[3].
Polygraphus rufipennis, 419[8].
polyphemus, Telea, 558[3].
polyxenes, Papilio, 557[3].
pomonella, Carpocapsa, 422[2].
Poplar, insects injurious to:
Idiocerus lachrymalis, 507[3].
suturalis, 506[5].
Pediopsis bifasciata, 505[2].
populata, Eustroma, 560[6].
Porthetria dispar, 382[3]-85[2].
portlandia, Enodia, 557[6].
portoricensis, Megarhinus, *see* Megarhinus portoricensis.
Potato beetle, 412[9], 413[7], 414[8], 414[9], 415[2], 415[4], 415[5], 415[6], 416[6].
Potato bugs, 413[9].
Potato gall, oak, 425[6].
Potato stalk borer, 415[2], 415[9], 417[7].
Potatoes, insects injurious to:
Agrotis messoria, 407[4].
Crepidodera cucumeris, 406[8], 414[8].
Drasterius elegans, 422[5].
Megoura solani, 414[2].
praegrandaria, Metrocampa, 560[7].
prasina, Adelphagrotis, 558[8].
prasina, Tettigonia, 511[8].
pratensis, Lygus, 551[3].
precationis, Autographa, 559[3].
Proconia undata, 509[2].
producta, Tettigonia, 511[3].
productus, Scaphoideus, 525[5].
progne, Polygonia, 557[5].
Protenor belfragei, 549[2].
Proteoteras aesculanum, 561[6].
proteus, Clastoptera, 553[6].
Protoculex serratus, 447[2], 449[2], 490[7].
explanation of plate, 564[2].
figure, 463.
Provancher, cited, 499[8], 547[7], 553[7].
provancheri, Idiocerus, 507[7], 554[6].
prunata, Eustroma, 560[6].
pruni, Bythoscopus, 503[5], 554[2].
Psallus *n. sp.*, 552[4].
pseudargyria, Heliophila, 559[6].
Pseudothyatira cymatophoroides, 560[1].
expultrix, 560[1].
Psorophora ciliata, 448[2], 471[5].
Psylla *sp.*, 556[7].
pyricola, 359[5], 412[2], 413[2], 414[3], 416[2], 416[3], 417[4], 417[5], 418[6], 422[2], 422[5], 425[2].
Psyllidae, 556[7].
Pteronus ribesii, 413[1], 413[6], 414[7].
Pterophoridae, 561[4].
Pterophorus homodactylus, 561[4].
paleacus, 561[4].
pubescens, Glyptoscelis, 419[6].
Publications, 361[4], 418[7]–26[8].

puella, Liburnia, 553[2].
pulcriventer, Culex, *see* Culex pulcriventer.
pulicarius, Chlamydatus, 552[3].
pulicarius, Xestocephalus, 515[5], 515[8], 554[7].
pullatus, Culicada, *see* Culicada pullatus.
pulvipennella, Depressaria, 561[7].
punctata, Cicada, 541[2].
punctata, Pelidnota, 425[4].
punctata, Typhlocyba, 541[2].
punctatus, Gnathodus, 541[1], 556[2].
punctatus, Jassus, 541[2].
punctifrons, Cicada, 540[7].
punctifrons, Cicadula, 540[7].
punctifrons, Jassus, 540[8].
punctifrons, Thamnotettix, 540[8].
punctifrons *var.* americana, Cicadula, 540[6].
punctipennis, Anopheles, 420[8], 449[7], 469[8]–70[1].
punctiscuta, Thamnotettix, 537[1].
purata, Cinglis, 560[8].
purpurigera, Panchrysia, 559[2].
purpurissata, Mamestra, 559[3].
pusilla, Chrysobothris, 419[7].
pustularia, Physostegania, 560[9].
pylades, Thorybes, 557[9].
Pyralidae, 561[2].
Pyralis cuprina, 561[2].
pyramidoides, Pyrophila, 558[7].
pyramusalis, Heterogramma, 559[7].
Pyrausta aeglealis, 561[3].
orphisalis, 561[4].
pertextalis, 561[3].
phoenicealis, 561[2].
theseusalis, 561[3].
thestealis, 561[3].
unifascialis, 561[4].
Pyrethrum, 424[4].
Pyretophorus costalis, 471[2].
explanation of plate, 562[7].
pyricola, Psylla, *see* Psylla pyricola.
Pyrophila pyramidoides, 558[7].
Pytho americanus, 419[4].

quadrangularis, Aphrophora, 419[6].
quadrivittata, Tettigonia, 510[8], 510[9].
quadri-angularis, Lepyronia, 553[5].
quadri-lineatus, Aradus, 549[8].
quadri-notata, Aphrophora, 553[5].
quadri-punctata, Cicadula, 535[9].
quadri-punctatus, Bythoscopus, 508[2].
Quayle, H. G., acknowledgments to, 443[5].
quebecencis, Gypona, 512[9], 553[9].
Queens county, summary of voluntary reports from, 416[5].
querci, Empoa, 545[5].
querci, Typhlocyba, 545[5], 556[6].
querci *var.* bifasciata, Typhlocyba, 545[6].
quinquelinearia, Leptomeris, 560[9].
quinquevittatus, Eretmapodites, *see* Eretmapodites quinquevittatus.

ramosula, Actinotia, 558[7].
ramosus, Paraphlepsius, 532[2].
rapae, Pieris, *see* Pieris rapae.
Raphia frater, 558[6].
rapidus, Calocoris, 551[2].
Raspberry bushes, insects injurious to:
Aphis mali, 416[7].
Jassus olitorius, 539[6].
Rhinocapsus vanduzei, 552[1].
Typhlocyba tricincta, 544[7].
Rathvon, cited, 547[6].
reclivata, Telamona, 552[8].
rectangula, Autographa, 559[3].
rectangulata, Habrosyne, 560[1].
redimicula, Paragrotis, 559[3].
Reduviidae, 550[3].
relicta, Catocala, 559[5].
Remedies and preventives for:
ants, 425[6].
apple caterpillar, red-humped, 404[4].
apple leaf miners, 425[9].
appletree bark louse, 421[2].
brown tail moth, 386[7].
cabbage worm, 424[4].
cockscomb elm gall, 424[2].
cucumber flea beetle, 406[6].
cutworm, dark-sided, 407[6], 424[2].
gipsy moth, 385[1].
grape root worm, 360[3], 369[3]-80[7], 381[6]-82[2], 420[3], 423[8], 425[1].
grapeberry moth, 418[9].

Remedies (*continued*)
Julus caeruleocinctus, 423[7].
larder beetle, 410[3], 424[9].
oak potato gall, 425[7].
pea louse, 408[8].
pear psylla, 422[4], 425[2].
plant lice, 425[4].
rose leaf hopper, 415[8].
San José scale, 360[4], 386[9]-403[3], 419[2], 421[1], 421[9], 422[1], 424[3], 425[1], 425[3], 425[5].
sugar maple borer, 423[7].
tussock moth, white marked, 405[8].
violet sawfly, 406[6].
wire worms, 422[4].
Remedies and preventives for insect depredations:
arsenate of lead, 404[4].
arsenical poison, 371[7]-80[7], 386[8], 406[6].
ashes, 406[9].
beetle catcher, 369[4]-71[6], 423[3].
bordeaux mixture, 396[3], 399[2], 406[8].
bran mash, poisoned, 407[7].
carbon bisulfid, 410[3], 425[6].
caustic soda solution, 395[8]-96[2], 399[2].
dust sprays, 419[1].
hellebore, 424[4].
hydrocyanic acid gas, 410[3].
kerosene, 408[8].
lime-sulfur wash, 360[4], 386[9]-403[3], 419[2], 420[2], 421[1], 422[1].
london purple, 404[4].
paris green, 404[4], 407[6].
petroleum, crude, 419[2], 421[1], 422[1].
plaster of paris, 406[9].
pyrethrum, 424[4].
whale oil soap, 408[8], 419[2].
remigis, Hygrotrechus, 550[2].
remipes, Sabethes, *see* Sabethes remipes.
Renia discoloralis, 559[7].
flavipunctalis, 559[7].
fraternalis, 559[7].
renigera, Mamestra, 559[4].
Report of State Entomologist for 1903, 424[4].
resedae, Ischnorhynchus, 549[4].
resinicola, Diplosis, 419[5].
restuans, Culex, 446[1], 483[6].
Retinia, pitch pine, 419[5].
Retinia (Evetria) comstockiana, 419[5].
frustrana, 419[5].
rigidana, 419[5].
reversalis, Pediopsis, 505[3].
Rhagium, ribbed, 419[4].
Rhagium lineatum, 419[4].
Rhagoletis cingulata, 416[4].
Rhagovelia obesa, 550[1].
Rheumaptera hastata, 560[6].
Rhinocapsus vanduzei, 552[1].
Rhodophora florida, 559[2].
Rhynchagrotis a. brunneipennis, 558[8].
alternata, 558[8].
anchocelioides, 558[8].
gilvipennis, 558[7].
ribearia, Cymatophora, 560[5].
ribesii, Pteronus, 413[1], 413[6], 414[7].
Richmond county, summary of voluntary reports from, 416[7]-17[3].
rigidana, Retinia, 419[5].
rimosalis, Evergestis, 415[2].
rivularis, Acocephalus, 515[1].
Rockland county, summary of voluntary reports from, 417[3].
rosae, Cicada, 545[8].
rosae, Tettigonia, 545[8].
rosae, Typhlocyba, *see* Typhlocyba rosae.
Rose beetle, 415[2], 415[4], 417[6], 417[8].
Rose leaf hopper, 415[5], 415[8].
Rosebushes, insects injurious to:
plant lice, 413[6].
Schizura concinna, 404[4].
Typhlocyba rosae, 545[9].
rosea, Oreta, 560[3].
rotundifolia, Sayomyia, 497[5].
rubellus, Miris, 550[8].
rubidana, Galasa, 561[3].
rubra, Typhlocyba, 545[4].
ruficilliata, Mesoleuca, 560[6].
ruficornis, Trigonotylus, 550[7].
rufimargo, Panapoda, 559[6].
rufipennis, Polygraphus, 419[8].
rufiventris, Aulacizes, 509[6].
rufusculus, Coriscus, 550[3].
rugosa, Gypona, 513[6].
rugulosus, Scolytus, 403[4], 421[5].

Sabethes remipes, 462[6].
explanation of plate, 562[5].

Sabulodes transversata, 560[9].
Sagittaria, Phlepsius humidus injuring, 532[3].
Salda deplanata, 550[5].
pallipes, 550[5].
Saldidae, 550[5].
Salebria basilaris, 561[4].
salinarius, Culex, 445[8].
samoset, Amblyscirtes, 557[9].
San José scale, 359[6], 412[1], 416[6], 417[2], 421[4], 421[5], 422[2], 424[3], 425[1], 425[2], 425[3], 425[5]; experiments in controlling, 386[9]-403[3]; methods of controlling, 360[4]; observations, 398[7]-400[8]; recommendations, 400[9]; remedies, 421[9]; sprays for 419[2].
sanctus, Scaphoideus, 523[7].
Sanders, J. G., collection received from, 362[4].
sanguinolenta, Agallia, 508[4], 554[6].
sanguinolentus, Bythoscopus, 508[4].
Saperda, monograph of genus, 422[5].
sapphirina, Uranotaenia, 447[4], 493[2].
saratogensis, Aphrophora, 419[6].
sassacus, Erynnis, 557[9].
Saturniidae, 558[3].
Sawfly, Le Conte's, 419[6].
violet, 406[4].
Say, cited, 499[7], 516[8].
sayi, Amblycephalus, 519[6].
sayi, Deltocephalus, 519[6], 555[1].
sayi, Jassus, 519[6].
Sayomyia, 449[8].
albipes, 497[4].
hudsoni, 497[2].
rotundifolia, 497[5].
trivittata, 497[1].
scalaris, Scaphoideus, 523[9].
scale insects, 420[9]; affecting trees, 440[2].
scandens, Paragrotis, 559[3].
Scaphoideus, 501[4], 523[5].
auronitens, 524[4].
carinatus, 525[3].
consors, 523[6].
immistus, 525[6], 555[7].
intricatus, 525[2].
jucundus, 524[8].
lobatus, 524[2].
luteolus, 524[1].
Scaphoideus ochraceus, 525[1].
opalinus, 525[8]–26[6].
productus, 525[5].
sanctus, 523[7].
scalaris, 523[9].
scarlatina, Gypona, 513[1].
Scepsis fulvicollis, 558[4].
Schizoneura americana, 406[1].
lanigera, 414[9].
Schizura concinna, 403[7]–4[5], 425[8].
unicornis, 559[9].
schlaegeri, Stenoma, 561[7].
Sciagraphia flavivenata, 560[9].
granitata, 560[4].
mellistrigata, 560[4].
Scoliopteryx libatrix, 559[8].
Scolops sulcipes, 552[9].
Scolytus rugulosus, 403[4], 421[5].
scripta, Habrosyne, 560[1].
scutellaris, Bomolocha, 559[8].
scutellaris, Stegomyia, 489[9]–90[1].
Scutigera forceps, 424[3].
secutor, Culex, 446[3].
Sedge, Thamnotettix melanogaster injuring, 537[9].
Sehirus cinctus, 548[5].
Selenocephalus agrestis, 514[7].
vitellinus, 516[4].
Selidosema humanarium, 560[5].
semiclusaria, Nepytia, 560[5].
seminuda, Eutettix, 529[9]–30[2].
seminudus, Athysanus, 530[1].
seminudus, Bythoscopus, 529[9].
seminudus, Eutettix, 530[1].
seminudus, Jassus, 529[9].
seminudus, Thamnotettix, 530[1].
Semiophora elimata, 558[8].
senatoria, Anisota, 419[9].
septentrionalis, Gluphisia, 559[9].
sereiventris, Podisus, 548[9].
Serica trociformis, 419[9].
serinaria, Plagodis, 560[7].
serrata, Haematobia, 415[3].
serratus, Protoculex, *see* Protoculex serratus.
Sesia pictipes, 561[2].
Sesiidae, 561[2].
sex-notata, Cicada, 539[9].
sex-notata, Cicadula, 539[8]–40[2], 556[1].
sex-punctatus, Jassus, 523[4].

Shade tree insects, 405[6]–6[4], 435[4]–36[6], 442[1].
siccifolia, Agallia, 508[5].
siccifolius, Bythoscopus, 508[4].
sigmoides, Eueretagrotis, 558[8].
signata, Tricholita, 559[6].
signatana, Thiodia, 415[7], 561[6].
signifer, Pneumaculex, *see* Pneumaculex signifer.
Silvanus surinamensis, 422[3].
similis, Chilocorus, 360[5], 411[5].
similis, Tettigonia, 510[1].
simplarius, Athysanus, 528[1].
simplex, Deltocephalus, 528[1].
Sinea diadema, 550[5].
Siphonaptera, contributions of, 428[5].
sitellata, Gypsochroa, 560[8].
Skinner, E. A., acknowledgments to, 364[3].
Skinner, E. W., acknowledgments to, 364[4].
Skinner, H., cited, 549[6].
Slingerland, cited, 498[3].
Slosson, cited, 547[8].
slossoni, Cicadula, 540[2], 556[2].
smaragdula, Cicada, 542[7].
smaragdula, Empoasca, 542[6].
smaragdula, Typhlocyba, 542[7].
smaragdulus, Kybos, 542[7].
Smerinthus cerysii, 558[2].
jamaicensis, 558[2].
Smith, J. B., acknowledgments to, 363[4], 443[5]; cited, 475[3], 547[7].
smithii, Noctua, 558[9].
smithii, Wyeomyia, *see* Wyeomyia smithii.
sobrius, Bythoscopus, 502[2].
socialis, Uranotaenia, 493[4].
solani, Megoura, *see* Megoura solani.
Soldier beetle, 408[6].
Solidago gall, 410[4].
sollicitans, Culicada, 449[2], 477[3].
Southwick, cited, 498[3], 511[7], 515[4], 523[3], 532[8], 547[3]; mentioned, 531[7].
southwicki, Eutettix, 531[7].
Spangbergiella, 501[3], 516[1].
vulnerata, 516[1].
Sparganothis xanthoides, 561[6].
spathipalpis, Theobaldia, *see* Theobaldia spathipalpis.
speciosus, Plagionotus, 423[7].
Sphingidae, 558[1].
Sphinx chersis, 558[1].
drupiferarum, 558[2].
kalmiae, 558[2].
Spittle insects, 419[6].
Spruce, insects injurious to, 419[8].
squammipenna, Aedeomyia, 462[4], 562[3].
Squash bugs, 413[8].
Squash vines, Diabrotica vittata injuring, 413[3].
Stal, cited, 549[9].
Stalk borer, 406[9]–7[3], 412[1].
Stegomyia fasciata, 449[3], 489[7], 490[3].
explanation of plate, 564[1].
notoscripta, 490[2].
scutellaris, 489[9]–90[1].
Stenocranus dorsalis, 553[1].
Stenoma schlaegeri, 561[7].
Sthenarops malina, 551[7].
Stictocephala inermis, 420[1].
lutea, 552[7].
stigmatus, Cixius, 552[9].
stipata, Hadena, 558[9].
Stiphrosoma, croseipes, 551[8].
stygica, 551[8].
Stone flies, monographic account of, 360[8].
straminalis, Evergestis, 561[2].
striata, Gypona, 512[9].
striatula, Cicada, 528[5].
striatulus, Athysanus, 528[5], 528[6], 528[7].
striatulus, Cryphalus, 419[8].
striatus, Acocephalus, 514[8].
striola, Athysanus, 527[6].
striola Cicada, 527[7].
striola, Limnotettix, 527[7].
strobi, Bythoscopus, 531[4].
strobi, Eutettix, 531[4].
strobi, Phlepsius, 531[4].
strobi, Pissodes, 419[4].
Strongylocephalus, 501[2], 514[6].
agrestis, 514[6].
stygica, Stiphrosoma, 551[8].
subbifasciata, Coelidia, 539[5].
subbifasciatus, Jassus, 539[5].
subcantans, Culex, 451[8].

subcantans, Culicada, *see* Culicada subcantans.
subcessaria, Cymatophora, 560[6].
subcoleoptratus, Coriscus, 550[4].
subfasciatus, Jassus, 539[6].
subgothica, Feltia, 559[2].
subsignarius, Ennomos, 560[7].
subspinosus, Macrodactylus, 415[2], 417[6].
Sugar maple borer, 423[7].
sulcipes, Scolops, 552[9].
surinamensis, Silvanus, 422[3].
suturalis, Bythoscopus, 506[7].
suturalis, Idiocerus, 506[7], 554[4].
suturalis, Pediopsis, 505[2].
suturalis *var.* lunaris, Idiocerus, 507[1], 554[4].
Sweet pea, Nectarophora [illegible] pisi, injuring, 408[3].
sylvestris, Deltocephalus, 519[9], 554[8].
sylvestris, Ecculex, 447[6], 479[8].
sylvestris, Ligyrocoris, 549[6].
Symmerista albifrons, 550[9].
Synelys alabastaria, 560[8].
ennucleata, 560[8].
synochitis, Eustrotia, 559[4].
Syntomidae, 558[3].
Syrphid fly, 408[8].
Systratiotus venaticus, 551[6].

tabaci, Thrips, 416[9].
Taeniorhynchus, 487[6]-90[9].
aurites, 464[1], 466[2], 487[9], 489[4].
explanation of plate, 563[9].
brevicellulus, 466[2], 488[1], 489[1].
explanation of plate, 563[9].
perturbans, 446[7], 466[4], 488[6]-89[1].
figure, 488.
explanation of plate, 563[8].
taeniorhynchus, Culicelsa, 449[1], 473[6].
tarquinius, Feniseca, 557[8].
tarsalis, Culex, 446[2], 484[2].
Telamona *sp.*, 552[8].
godingi, 420[1].
reclivata, 552[8].
Telea polyphemus, 558[3].
teliformis, Tettigonia, 510[8].
tenella, Tettigonia, 509[8].
tenerrima, Typhlocyba, 544[9], 556[6].
Tentiform miner, spotted, 404[7], 425[9].
unspotted, 404[6], 425[8].
tentoriferella, Machimia, 561[7].
Tephroclystis absinthiata, 560[6].
interruptofasciata, 560[6].
luteata, 560[4].
terebrans, Dendroctonus, 419[3].
tergata, Chlorotettix, 538[4], 555[9].
tergatus, Athysanus, 538[6].
tergatus, Bythoscopus, 538[5].
Termes flavipes, 419[4].
terrealis, Phlyctaenia, 561[3].
territans, Culex, 445[8], 483[9]-84[2].
tertialis, Phlyctaenia, 561[3].
tessellaris, Halisidota, 558[6].
tessellata, Paragrotis, 559[3].
testata, Eustroma, 560[6].
Tetracis crocallata, 560[9].
Tettigonia, 500[9], 509[7]-10[7].
acuta, 511[3].
angulifera, 511[6].
antica, 511[3].
bifida, 509[8].
comes, 545[2].
curtisii, 529[1].
fasciata, 509[8].
gothica, 510[1], 553[7].
herbida, 512[1].
hieroglyphica, 510[1], 553[7].
inimica, 523[3].
innotata, 511[3].
mali, 543[1].
mixta, 515[3].
mollipes, 511[3].
obliqua, 545[1].
octo-lineata, 512[9].
picta, 510[8].
prasina, 511[8].
producta, 511[3].
quadrivittata, 510[8], 510[9].
rosae, 545[8].
similis, 510[1].
teliformis, 510[8].
tenella, 509[8].
trifasciata, 544[8].
tripunctata, 510[6].
Tettigonidae, 500[6], 500[8], 509[1]-14[8], 553[8].
Tettigoninae, 500[9]-11[1].
textor, Hyphantria, *see* Hyphantria textor.
textrinaria, Metanema, 560[9].
Thamnotettix, 501[5].

belli, 534[4].
clitellarius, 534[6], 555[7].
cyperaceus, 538[1].
decipiens, 536[2], 555[7].
eburata, 534[5].
exquisitos, 534[9]-35[9].
figure, 535.
fitchi, 535[9]-36[2].
infuscata, 537[1], 555[9].
inornata, 536[3], 555[8].
kennicottii, 534[2], 555[7].
lurida, 530[4].
lusoria, 539[2].
melanogaster, 537[8].
placidus, 536[5], 555[8].
punctifrons, 540[8].
punctiscuta, 537[1].
seminudus, 530[1].
Thanaos icelus, 557[9].
lucilius, 557[9].
tharos, Phyciodes, 557[5].
Thelia acuminata, 420[1].
monticola, 420[1].
Theobald, F. V., acknowledgments to, 443[3]; cited, 461[1], 472[2].
Theobaldia annulata, 480[5].
explanation of plate, 563[5].
incidens, 448[3], 462[2], 480[7].
explanation of plates, 562[5], 563[5].
spathipalpis, 481[1].
explanation of plate, 563[6].
Therina fervidaria, 560[6].
theseusalis, Pyrausta, 561[3].
thestealis, Pyrausta, 561[3].
Thiodia signatana, 415[7], 561[6].
thoe, Chrysophanus, 557[8].
Thorn, insects injurious to:
Idiocerus crataegi, 507[2].
maculipennis, 507[6].
Schizura concinna, 404[4].
Thorybes pylades, 557[9].
Thrips tabaci, 416[9].
Thyatiridae, 560[1].
Thymelicus cernes, 557[9].
mystic, 557[8].
otho, 557[9].
thysbe, Hemaris, 558[1].
tibicen, Cicada, 420[1].
tigripes, Culex, *see* Culex tigripes.
tinctus, Calocoris, 551[2].
Tingidae, 549[7].
Tischeria malifoliella, 404[9], 425[9].
titillans, Mansonia, *see* Mansonia titillans.
Tlascala finitella, 561[3].
Tmetocera ocellana, 418[5].
Tobacco thrips, 416[9], 417[1].
Tomatoes, insects injurious to:
Crepidodera cucumeris, 406[8], 413[1], 417[9].
flea beetle, 415[1].
Papaipema nitela, 407[1].
Tomicus, southern, 419[3].
Tomicus balsameus, 419[9].
cacographus, 419[3].
caelatus, 419[4]
calligraphus, 419[3].
pini, 419[4].
Tortricidae, 561[5].
Tortrix argentana, 561[6].
conflictana, 561[6].
transversata, Sabulodes, 560[9].
Tree hopper, two marked, 420[1].
triangularis, Disonycha, 415[6].
Tricholita signata, 559[6].
Trichoptera, contributions of, 431[6].
trichurus, Culex, 451[8].
trichurus, Culicada, *see* Culicada trichurus.
tricincta, Erythroneura, 544[7].
tricincta, Typhlocyba, 544[6].
tricolorella, Mineola, 561[3].
trifasciata, Empoasca, 542[8].
trifasciata, Tettigonia, 544[8].
trifasciata, Typhlocyba, 544[8].
Trigonophora periculosa, 559[8].
Trigonotylus ruficornis, 550[7].
trimaculata, Bythoscopus, 504[5].
trimaculata, Pediopsis, 504[4], 504[9], 554[2].
Trioza tripunctata, 556[7].
Triphleps insidiosus, 550[7].
tripunctata, Tettigonia, 510[5].
tripunctata, Trioza, 556[7].
triseriatus, Culicada, 447[8], 477[8].
tristigmus, Euschistus, 548[7].
tristis, Anasa, 413[8].
trivittata, Sayomyia, 497[1].
trivittatus, Culicada, 447[9].
trociformis, Serica, 419[9].

Tropaea luna, 558[3].
Trumpet miner, 404[7], 425[9].
truncata, Mesoleuca, 560[7].
tuberculata, Paracoelidia, 539[7].
turbida, Ceresa, 552[8].
Turnip worm, black-headed, 415[1].
Turnips, Evergestis rimosalis injuring, 415[1].
Turpentine bark beetle, 419[3].
Tussock moth, white marked, 405[8], 416[9], 417[9]-18[1], 422[3].
Typhlocyba, 501[7], 544[5].
sp., 556[8].
albostriella, 541[8].
aurata, 541[8].
binotata, 541[8].
coccinea, 544[5].
comes, 545[2].
var. basilaris, 545[4].
var. vitis, 545[4].
var. rubra, 545[4].
var. vitifex, 545[3], 545[4].
var. vulnerata, 545[4].
var. ziczac, 545[4].
8-notata, 545[4].
illinoiensis, 545[9].
obliqua, 545[1].
pallida, 541[8].
photophila, 543[1].
punctata, 541[2].
querci, 545[5], 556[6].
var. bifasciata, 545[6].
rosae, 415[5], 415[8], 545[8], 556[5].
smaragdula, 542[7].
tenerrima, 544[9], 556[6].
tricincta, 544[6].
trifasciata, 544[8].
ulmi, 545[7].
vernalis, 541[2].
Typhlocybidae, 500[7], 501[6], 541[7], 556[3].

u-aureum, Autographa, 559[3].
Uhler, cited, 499[7], 523[6], 534[2], 534[5]; mentioned, 539[8].
ulmi, Anomia, 545[7].
ulmi, Cicada, 545[7].
ulmi, Lepidosaphes, 414[9], 421[2], 421[4].
ulmi, Typhlocyba, 545[7].
ulmicola, Colopha, 424[2].
ulmifolii, Callipterus, 415[3], 417[8].
unangulata, Hydriomena, 560[7].
undata, Mormidea, 548[8].
undata, Neottiglossa, 548[8].
undata, Oncometopia, 509[1].
undata, Proconia, 509[2].
underwoodi, Eucorethra, 449[7], 496[1].
undulata, Hydria, 560[5].
undulata, Notonecta, 552[4].
undulosa, Ceratomia, 558[1].
unicolor, Athysanus, 538[3].
unicolor, Bythoscopus, 538[2].
unicolor, Chlorotettix, 538[2], 555[9].
unicornis, Schizura, 559[9].
unifascialis, Pyrausta, 561[4].
unifasciatus, Poecilloscytus, 551[4].
unijuga, Catocala, 559[5].
unipuncta, Heliophila, 559[5].
Uranotaenia sapphirina, 447[4], 493[2].
socialis, 493[4].
urentis, Ambrostola, 559[4].

vaccinii, Athysanus, 528[7], 555[3].
Van Duzee, E. P., work of, 361[3], 498[2], 498[5]; cited, 498[3], 499[7], 499[8], 500[3], 502[4], 503[2], 503[6], 504[8], 504[7], 504[9], 505[1], 505[2], 505[4], 506[1], 506[3], 506[8], 506[9], 507[1], 507[2], 507[4], 507[6], 507[8], 508[3], 508[5], 508[6], 508[8], 508[9], 509[2], 509[9], 510[2], 511[1], 511[5], 511[7], 512[5], 512[7], 513[5], 514[8], 514[9], 515[5], 515[7], 515[9], 516[6], 516[9], 517[8], 520[2], 520[4], 520[9], 521[6], 522[9], 523[9], 524[5], 524[9], 525[2], 525[3], 525[8], 527[6], 527[8], 528[2], 528[3], 528[5], 529[7], 530[2], 531[5], 531[9], 532[3], 532[4], 532[6], 532[7], 533[1], 533[2], 533[4], 533[5], 534[4], 535[8], 536[1], 538[4], 538[8], 538[8], 538[9], 539[3], 539[8], 539[9], 540[1], 540[3], 540[5], 540[8], 540[8], 541[3], 541[4], 542[9], 543[4], 543[5], 543[7], 543[8], 547[7]; acknowledgments to, 499[4]; mentioned, 504[3], 505[3], 515[1], 517[5], 519[9], 520[7], 521[2], 527[4], 528[9], 530[3], 531[3], 533[9], 535[8], 536[3], 536[4], 536[8], 537[7], 538[1], 541[1], 541[6], 541[9], 542[3], 542[5], 542[6], 542[8], 544[9], 545[6], 545[9]; List of Hemiptera Taken in the Adirondack Mountains, 546[1]-56[8].
vanduzei, Eupteryx, 543[7], 556[4].
vanduzei, Rhinocapsus, 552[1].

Vanessa atalanta, 557[5].
cardui, 557[6].
huntera, 557[5].
variabilis, Athysanus, 501[8].
variabilis, Bythoscopus, 501[8]-2[2]. 502[8].
variata, Cicada, 540[1].
variata, Cicadula, 540[4], 556[2].
variata, Limotettix, 540[4].
variatus, Jassus, 540[4].
varipalpus, Culicada, 447[9].
vecors, Orthodes, 559[6].
vecors, Perigea, 558[8].
venaticus, Systratiotus, 551[5].
venosus, Athysanus, *see* Athysanus venosus.
Venusia cambrica, 560[5].
vernalis, Typhlocyba, 541[2].
vernata, Paleacrita, 416[1], 418[5].
verticis, Bythoscopus, 507[9].
verticis, Idiocerus, 507[9]-8[1].
verticis, Jassus, 507[9].
vestaliata, Orthofidonia, 560[9].
vialis, Amblyscirtes, 557[8].
vicaria, Penthimia, 514[4].
vicarius, Coriscus, 550[4].
videns, Platysenta, 558[8].
Violet sawfly, 406[4].
virescana, Archips, 561[5].
virescens, Xerophloea, 512[6].
virescens *var.* graminea, Pediopsis, 505[5].
virginica, Ctenucha, 558[4].
virginica, Diacrisia, 558[6].
virgo, Apantesis, 558[5].
viridescens, Empoasca, 543[6].
viridia, Chlorotettix, 538[7], 555[9].
viridis, Acopsis, 511[4].
viridis, Cercopis, 512[5].
viridis, Glossocratus, 515[9].
viridis, Gnathodus, 541[4], 556[3].
viridis, Parabolocratus, 515[8].
viridis, Pediopsis, 504[6], 554[2].
viridis, Xerophloea, 512[5].
viridius, Athysanus, 538[7].
viridiventer, Culex, *see* Culex viridiventer.
vitellinus, Acocephalus, 516[4].
vitellinus, Parabolocratus, 516[4].
vitellinus, Paramesus, 516[3], 554[7].
vitellinus, Selenocephalus, 516[4].
viticida, Fidia, *see* Fidia viticida.
vitifex, Erythroneura, 545[3].
vitifex, Typhlocyba, 545[3], 545[4].
vitis, Lasioptera, 416[9].
vitripennis, Hyaliodes, 551[7].
vittata, Culicada, 446[5].
vittata, Diabrotica, *see* Diabrotica vittata.
vittipennis, Laccocera, 553[2].
Voluntary entomologic service of New York State, 363[2], 411[8]-18[6].
vulgaris, Lamenia, 553[4].
vulnerata, Erythroneura, 545[4].
vulnerata, Spangbergiella, 516[1].
vulnerata, Typhlocyba, 545[4].
vulneratus, Glossocratus, 516[1].

Walker, C. M., resignation, 359[9].
walkeri, Howardina, 449[4].
Warren county, summary of voluntary reports from, 417[5].
Wasps disappearing, 422[3].
Weed, C. M., mentioned, 515[2].
Westchester county, summary of voluntary reports from, 417[9]-18[4].
Whale oil soap, 408[8], 419[2].
White flower cricket, 421[8].
Whortleberry bushes, insects injurious to:
Gypona rugosa, 513[6].
Willow, insects injurious to:
Ceresa turbida, 552[6].
Cicadula punctifrons, *var.* americana, 540[7].
Diommatus congrex, 550[9].
Idiocerus pallidus, 506[2].
suturalis, 506[8].
Pediopsis virescens *var.* graminea, 505[8].
viridis, 504[7], 554[2].
Winter insects in New York, 420[8].
Wire worms, 422[4].
Wirtner, Modesto, mentioned, 529[8].
Wirtner, P. M., cited, 547[9].
Woolly aphids, 414[9].
Wyeomyia smithii, 444[5], 446[7], 463[5], 464[3], 491[2], 493[6]-94[1].
figures, 464.
Wyoming county, summary of voluntary reports from, 418[5].

xanthoides, Sparganothis, 561[6].
Xanthotype crocataria, 560[7].
Xerophloea, 501[2].
  grisea, 512[6].
  major, 512[7].
  peltata, 512[6].
  virescens, 512[6].
  viridis, 512[5].
Xestocephalus, 515[5].
  fulvocapitatus, 515[7].
  pulicarius, 515[5], 515[8], 554[7].
xylinoides, Hyppa, 558[7].
Xylorictidae, 561[7].
Xyloterus bivittatus, 419[4].
  politus, 419[5].

Young, D. B., promotion, 359[9]; investigations on mosquitos, 361[1].
ypsilon, Agrotis, 558[9].

Zanclognatha laevigata, 559[7].
  marcidilinea, 559[7].
ziczac, Typhlocyba, 545[4].
zimmermani, Pinipestis, 419[5].